Token Engineering in Practice: Ecosystem sustainability & data markets

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trent.st/content/uofm.pdf

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Outline

- Introduction to Token Engineering (TE)
- TE applied to ecosystem sustainability
- TE applied to data markets

Engineering

is the creative application of science,
mathematical methods, and empirical evidence

to the innovation, design, construction,
operation and maintenance

of structures, machines, materials, devices,
systems, processes, and organizations.

Intro to Token Engineering (TE)

Science ↔ Engineering

- **Engineering** is about building things that work.
- **Science** is about contributing new knowledge.
- They're complementary.

Therefore Token Engineering is complementary to the science of Cryptoeconomics / Token Economics.

Electrons : Electrical Engineering

Tokens : Token Engineering

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First introduction of “Token Engineering” (Mar 2018)

Towards a Practice of Token Engineering

Methodology, Patterns & Tools. TE Series Part II.

In my previous article, I described *why* we need to get incentives right when we build tokenized ecosystems. Here, I ask: *how* do we design incentives for these tokenized ecosystems? And actually since incentives are the heart of tokenized ecosystems, it’s really: *how do we design tokenized ecosystems?* And, how do we *analyze* and *verify* them?

This article is a first stake in the ground towards a practice of **token engineering**: the theory, practice and tools to analyze, design, and verify tokenized ecosystems.

The first section of this article relates token designs to other fields and explains why “engineering”. The rest of this article is an attempt to draw us closer to this goal, by leveraging existing fields in three main ways:

- We can frame **token design as optimization design**, then use optimization design methodology.
- Inspired by **software engineering patterns**, we can document emerging patterns for token design.
- **Simulation, verification, and design space exploration (CAD tools)** for circuit design have helped engineers analyze, design, and verify

https://blog.oceanprotocol.com/towards-a-practice-of-token-engineering-b02feeeff7ca

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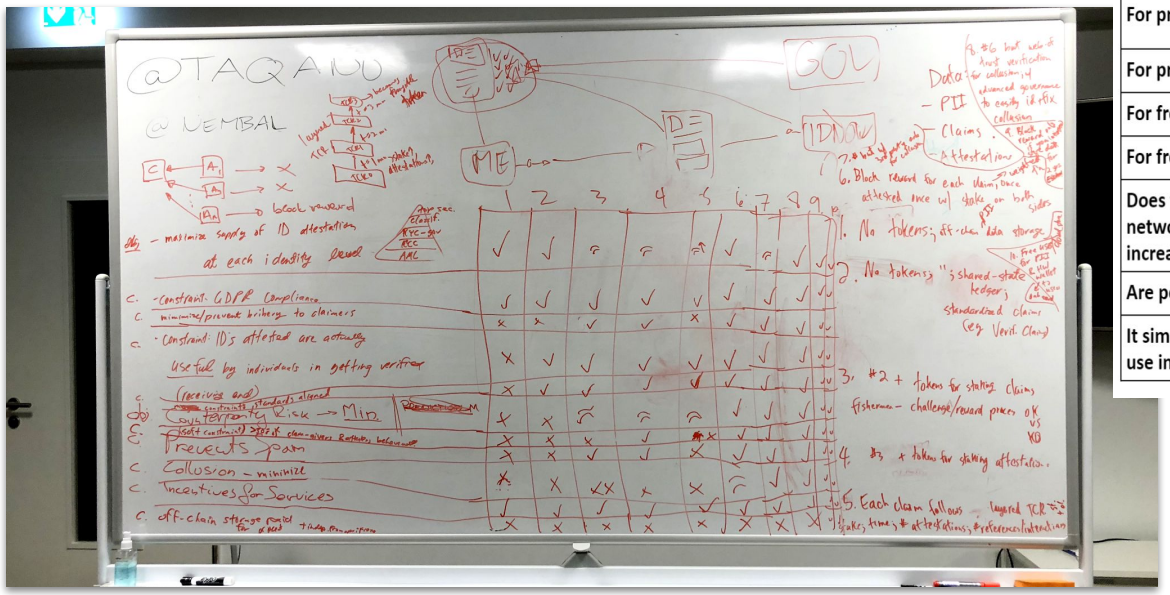
A TE Design Process

1. **Formulate the problem.** Stakeholders -> objectives, constraints, design space.
2. **Try existing building blocks.** If needed, try different formulations or blocks.
3. **Design new block?** Only if needed!



[Worked example]

Key Question	1	2	3	4	5	6
For priced data: incentive for supplying more? Referring?	×	≈	✓	≈	≈	✓
For priced data: good spam prevention?	≈	✓	✓	✓	✓	✓
For free data: incentive for supplying more? Referring?	×	≈	×	✓	✓	✓
For free data: good spam prevention?	≈	✓	≈	✓	≈	✓
Does token give higher marginal value to users of the network, vs external investors? Eg Does return on capital increase as stake increases?	✓	✓	✓	✓	✓	✓
Are people incentivized to run keepers?						
It simple? Is onboarding low-friction? Where possible, do v use incentives/crypto rather than legal recourse?						

Criterion	Status Quo	1SS	LB	1SS + LB	1SS + LB + Dutch:Pub	1SS + LB + Dutch:Pub + rICO	1SS + Dutch:Pub
Simple -easy to understand. Mental model plays well with existing -smart contract SW simple: to implement, understand, maintain -GUI SW simple: to implement, understand, maintain	✓	✓	✓	✓	≈✓	×	✓
Avoids large price swings when people just want to stake OCEAN	×	✓	×	✓	✓	✓	✓
Solves price spikes at beginning	×	×	×	×	✓	✓	✓
Solves price spikes in market equilibrium	×	✓	✓	✓	✓	✓	✓
No risk of exit scam after IDO	××	✓	×	×	×	✓	×

TE Example 1: Ocean V1 (2017)

Key Question	1	2	3	4	5	6
For priced data: incentive for supplying more? Referring?	✗	≈	✓	≈	≈	✓
For priced data: good spam prevention?	≈	✓	✓	✓	✓	✓
For free data: incentive for supplying more? Referring?	✗	≈	✗	✓	✓	✓
For free data: good spam prevention?	≈	✓	≈	✓	≈	✓
Does token give higher marginal value to users of the network, vs external investors? Eg Does return on capital increase as stake increases?	✓	✓	✓	✓	✓	✓
Are people incentivized to run keepers?	≈	≈	✓	✓	✓	✓
It simple? Is onboarding low-friction? Where possible, do we use incentives/crypto rather than legal recourse?	✓	✓	≈	≈	✓	✓

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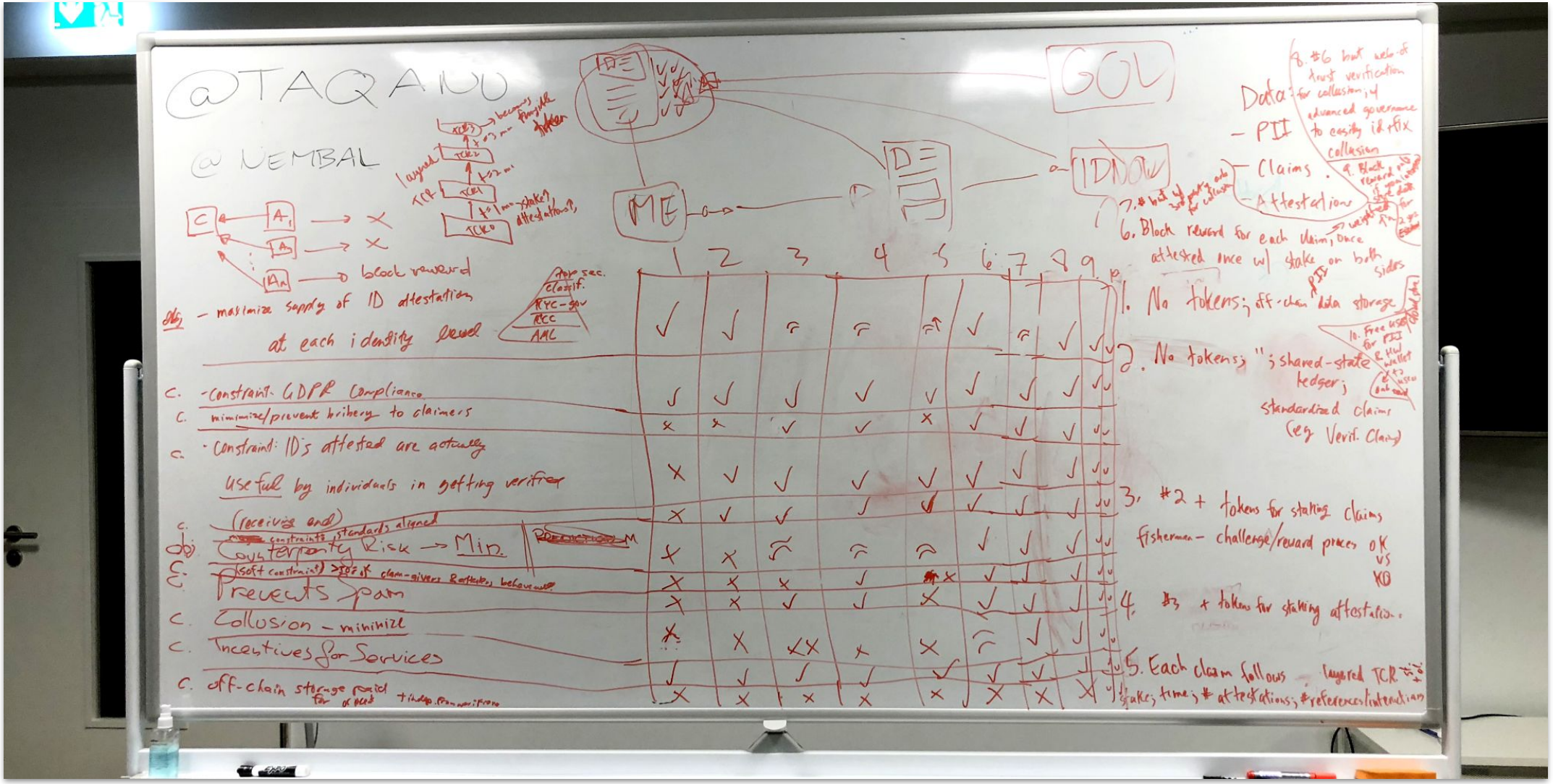
TE Example 2: Identity (2018)



[Reference]

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TE Example 3: Ocean V4 (2021)

Criterion	Ocean V3	LBP	1SS	LBP + 1SS	1SS + Dutch: Pub	1SS + Dutch: Pool	1SS + Dutch: Pool + Vesting	1SS + Vesting
Simple to understand, build, maintain	✔	✔	✔	✔	≈	✔	≈	✔✔
Avoids large price swings / IL when people just want to stake OCEAN	✖	✖	✔	✔	✔	✔	✔	✔
Solves price spikes at beginning	✖	✖	✔	✔	✔	✔	✔	✔
Solves price spikes in market equilibrium	✖	✔	✔	✔	✔	✔	✔	✔
Solve rug pulls	✖✖	✖	✔	✔	✔	✔	✔	✔
Good incentive for publisher to publish initially	✔✔	✖	✖	✖	✔	✖	✔	✔

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TE Community - Start

1st TE event
Berlin, Apr 2018

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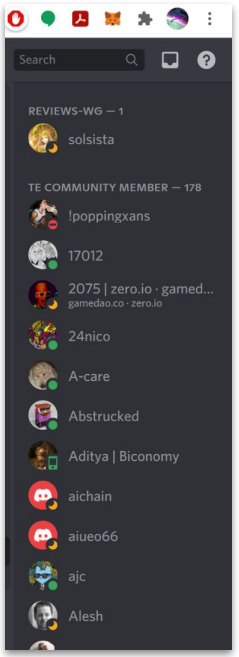
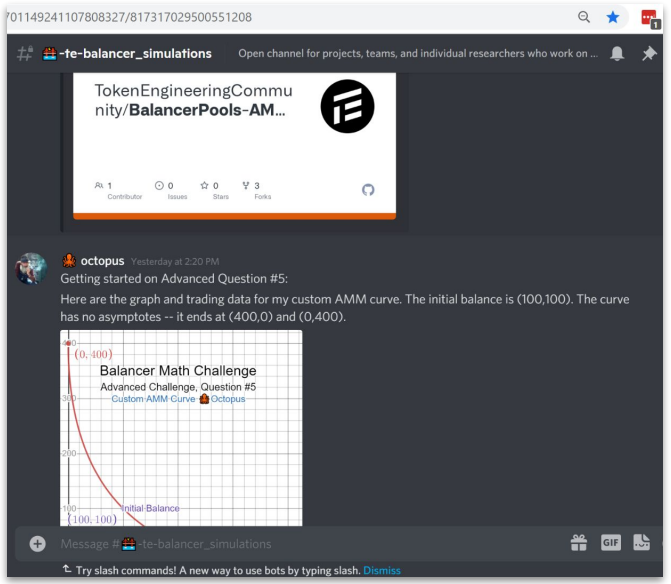
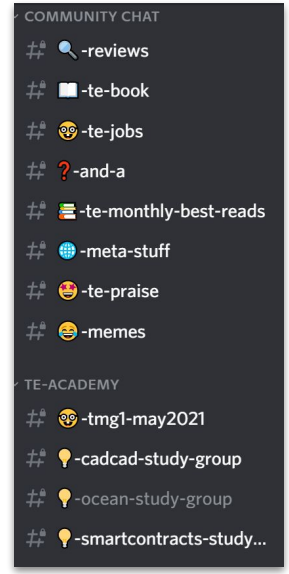
TE Community Now

1st TE event
Berlin, Apr 2018

Discord - primary gathering point

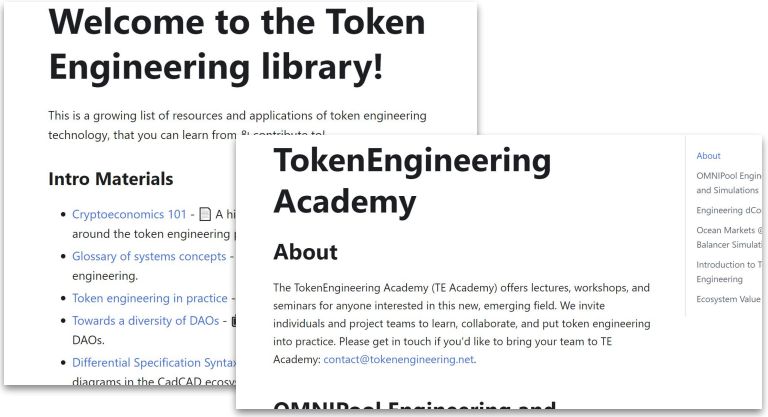




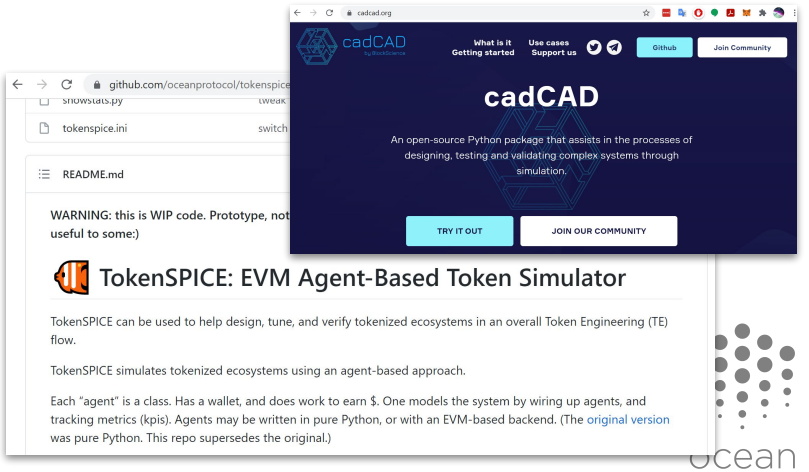


Global gatherings

Learning - via tokenengineering.org, more



Simulation Tools



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Token Engineering
applied to ecosystem sustainability

Goals

Find a design to enable...

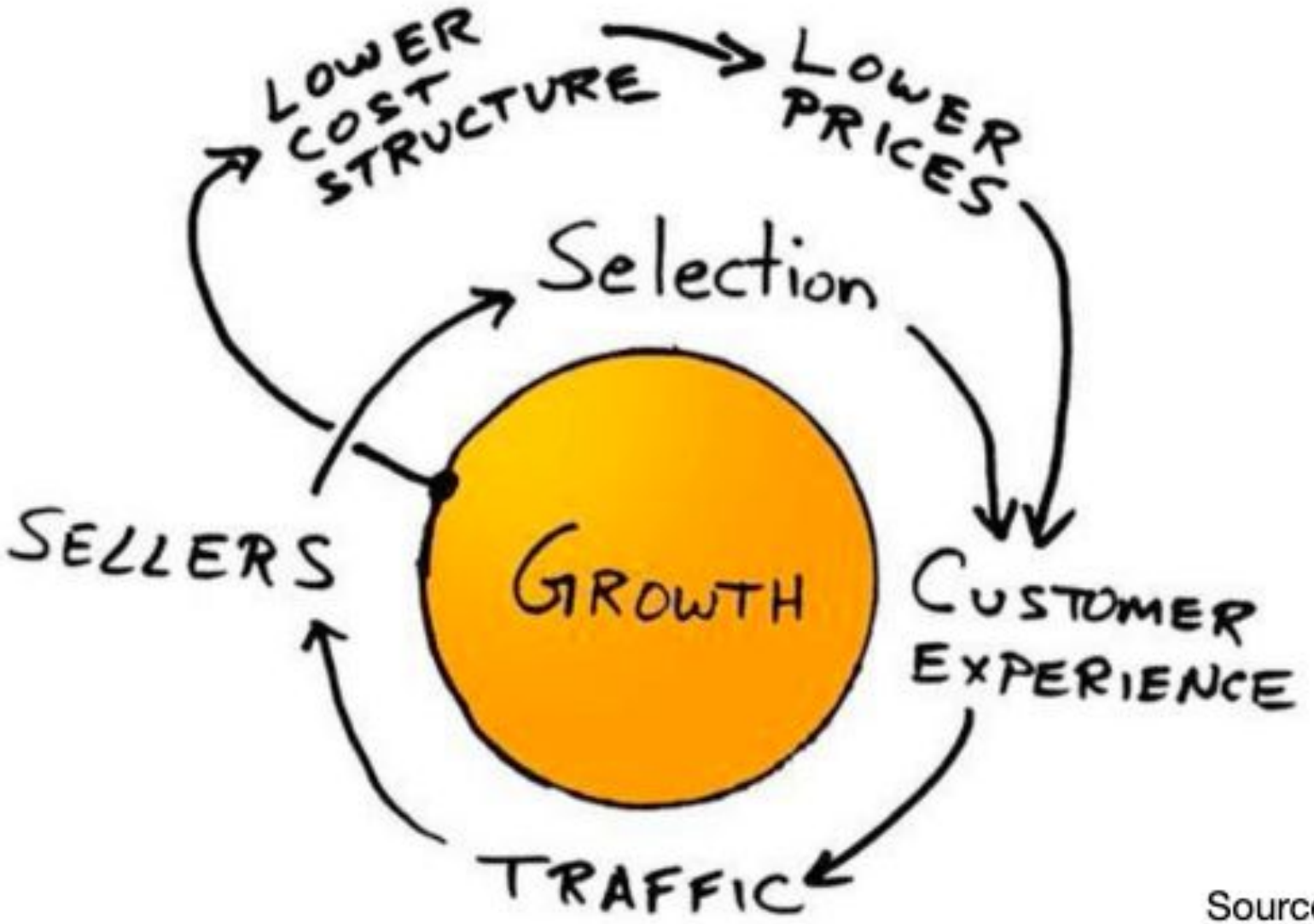
- Ecosystem sustainable and growing, towards ubiquity
- Funding goes to teams improving L1-L3 etc, over the long term (10+ years)
- $TOKEN grows as usage of network grows

Including:

- Basic design is simple to understand and communicate
- Can be implemented in a pragmatic fashion, over time
- Get people to do “work”,
- Encourage skin-in-the-game by users

A choice of system-level design will lead to goals of sub-blocks in the system.

How does Amazon work?



Source: Amazon

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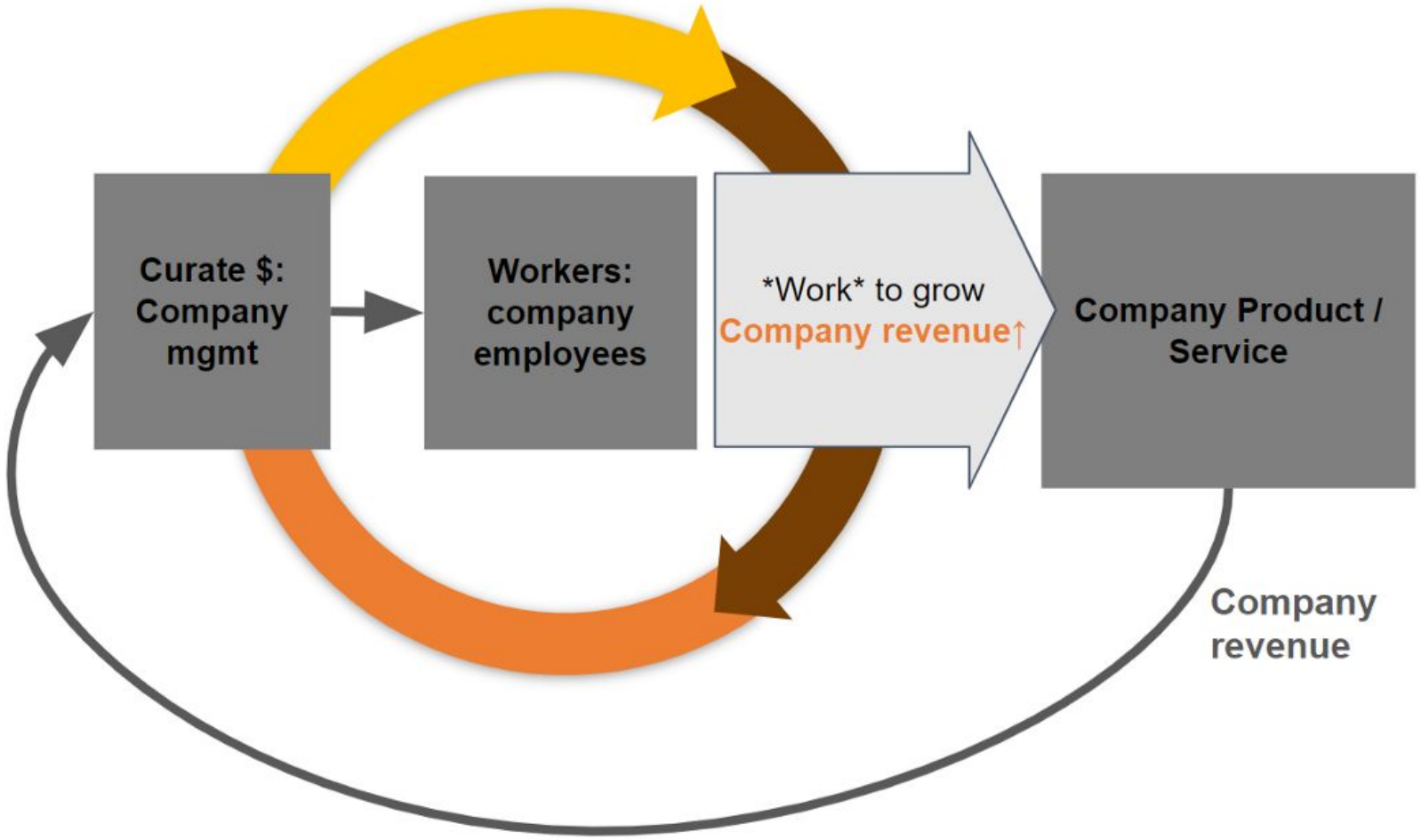
Company business model with a focus on revenue

Challenges: how to kickstart the company, how to grow fast enough to beat the competition



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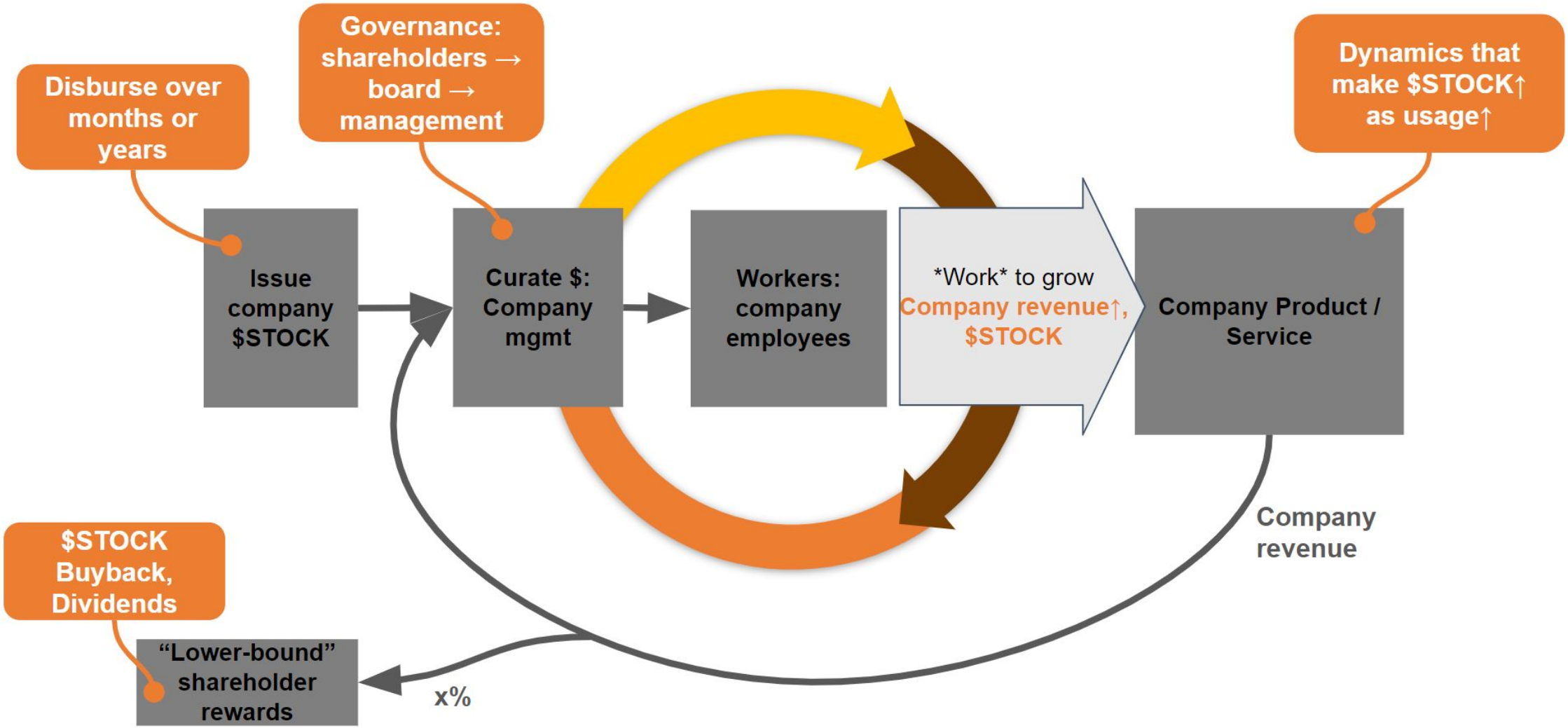
Company business model - full picture

Has an “outer wrapper” that uses stock as a tool, in addition to revenue.



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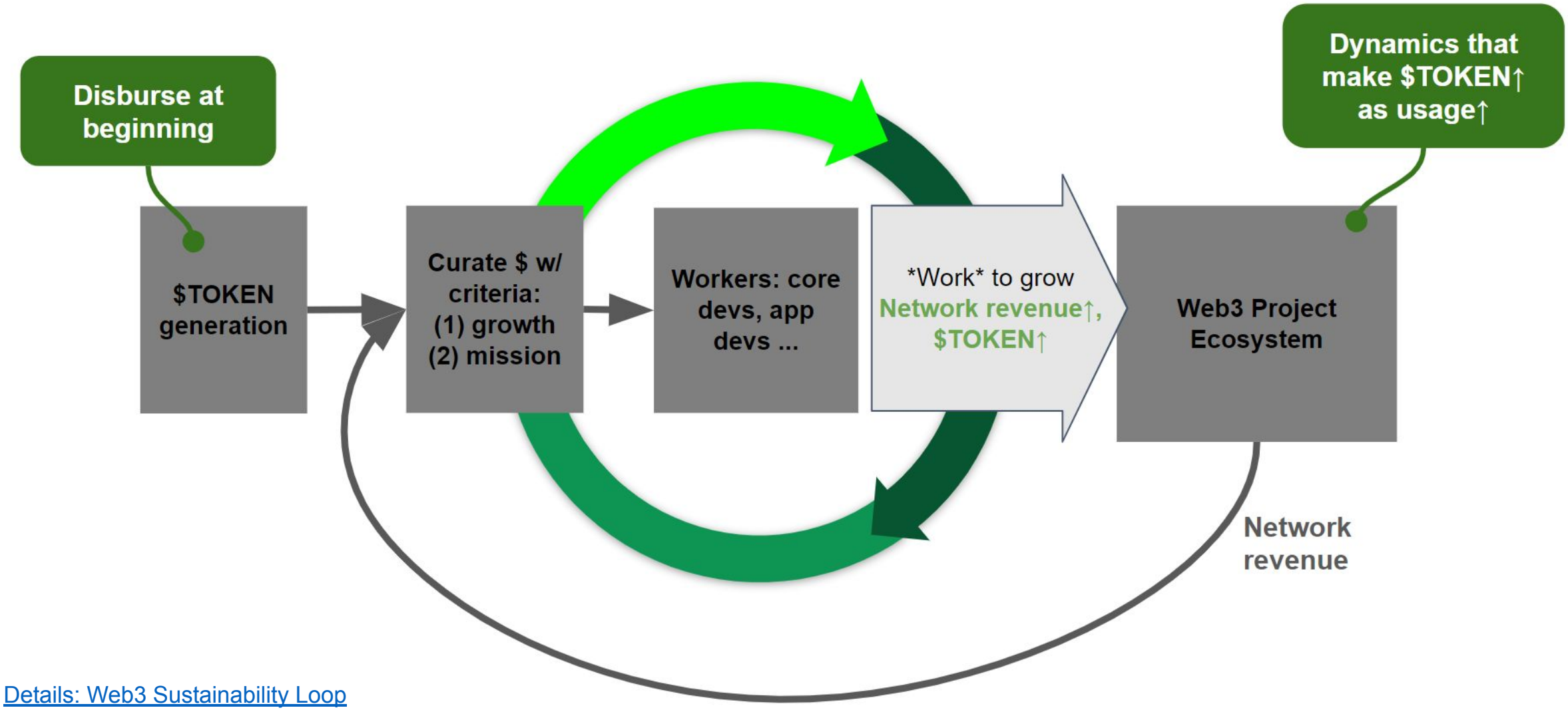
Web3 Sustainability Model with a focus on revenue

Challenges: how to kickstart the project, how to catalyze growth



Details: Web3 Sustainability Loop

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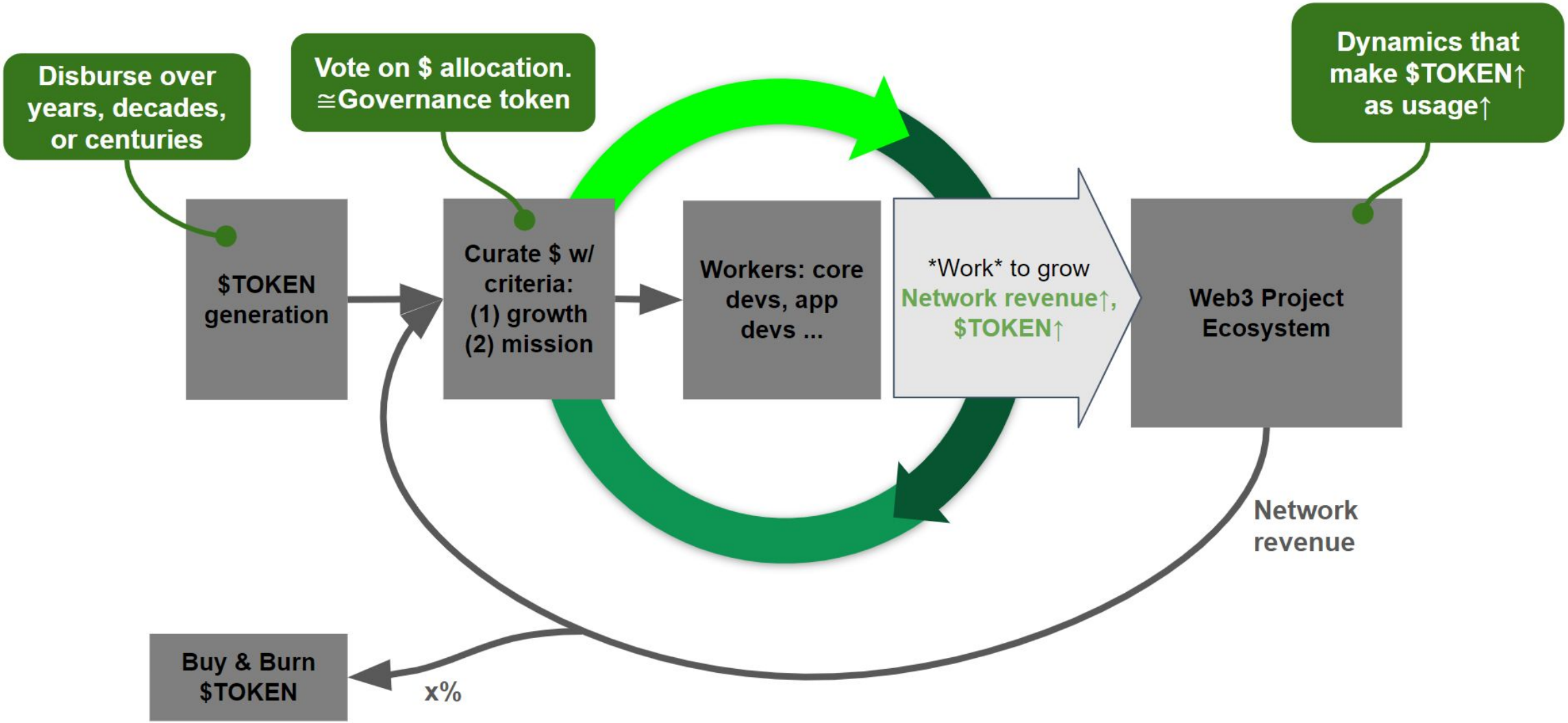
Web3 Sustainability Loop - full picture

Has an “outer wrapper” that uses tokens as a tool, in addition to revenue



[Details: Web3 Sustainability Loop]

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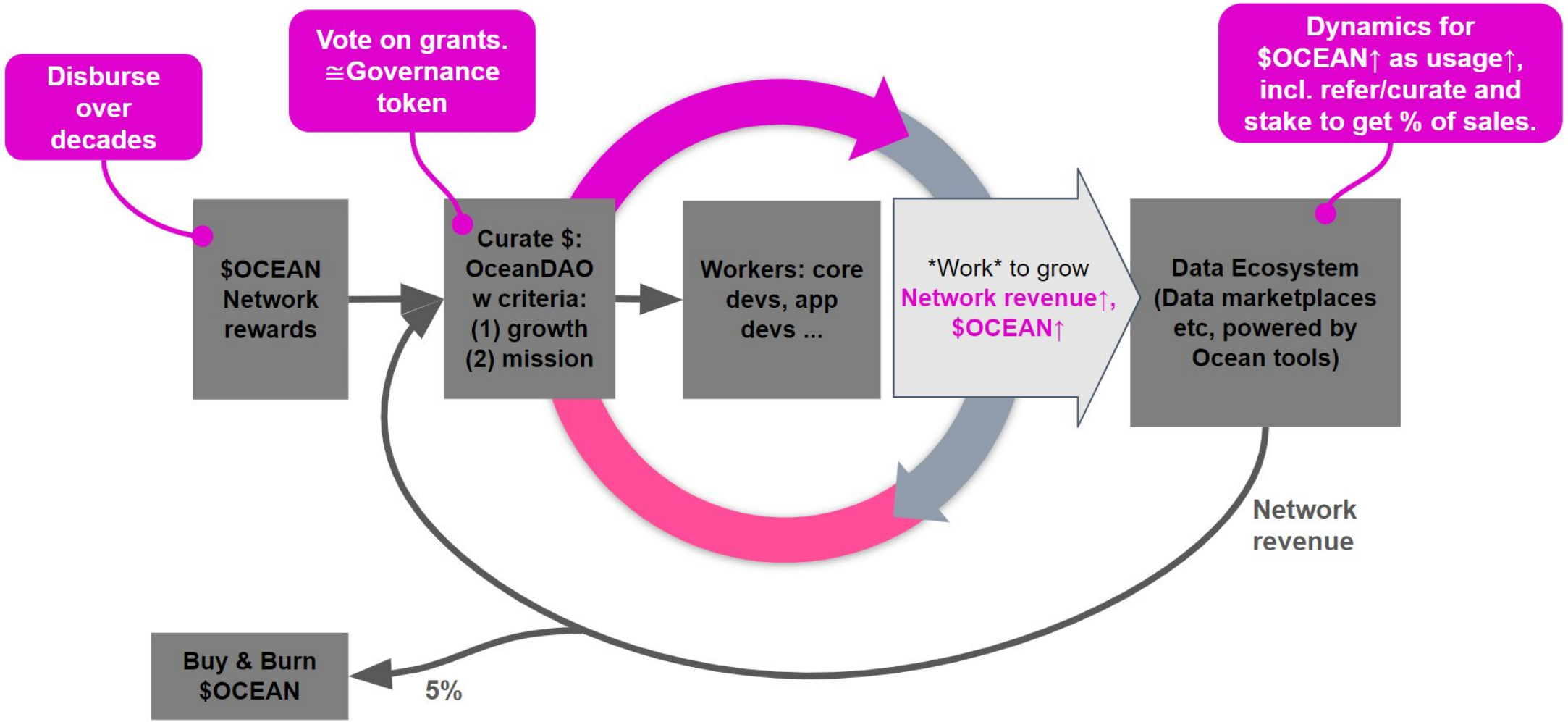
Ocean's Web3 Sustainability Loop

Revenue for long-term sustainability, OCEAN to catalyze it



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On Verifying Token-Based Systems

A Token Engineering perspective

Trent McConaghy
Jul 14 · 11 min read

> *"Trust, but verify" — Russian proverb*

Defining the Problem

***TE Verification* is about evaluating the token-based system to find out whether it meets the specified requirements.** The system could be a simple tool or a full tokenized ecosystem, instantiated as one or more smart contracts or even L1 blockchain networks.

https://blog.oceanprotocol.com/on-verifying-token-based-systems-c33eca757ecf

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On TE Verification

It’s pragmatic to do verification in **phases** of increasing fidelity:

1. **Humans.** Subjective discussions, with increasing # people. 1 →2 →key stakeholders
2. **Software modeling**, with increasing fidelity. Spreadsheet → agent-based sim → high-fid sim
3. **Economic (live)**. Can ratchet value-at-risk over time. People can choose risk/reward tradeoff. Phased approach.

https://blog.oceanprotocol.com/on-verifying-token-based-systems-c33eca757ecf

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Software-based Verification: TokenSPICE

https://github.com/tokenspice/tokenspice

TokenSPICE: EVM Agent-Based Token Simulator

Unit Testing and Code Coverage passing | MyPy Static Typechecking passing | coverage 92% | code quality A

TokenSPICE simulates tokenized ecosystems via an agent-based approach, with EVM in-the-loop.

It can help in Token Engineering flows, to design, tune, and verify tokenized ecosystems. It's young but promising. We welcome you to contribute! 👋

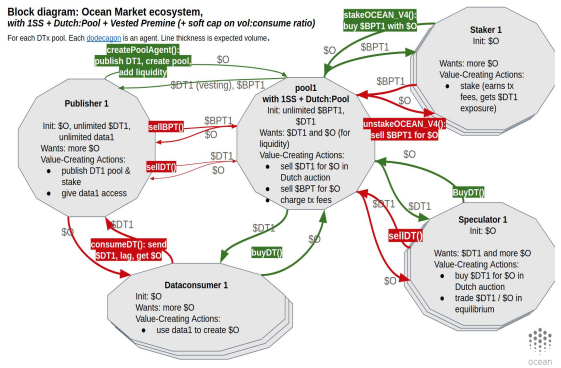
- TokenSPICE simulates by simply running a loop. At each iteration, each *agent* in the *netlist* takes a step. That's it! Simple is good.
- A netlist wires up a collection of agents to interact in a given way. Each agent is a class. It has an Ethereum wallet, and does work to earn money. Agents may be written in pure Python, or with an EVM-based backend.
- One models a system by writing a netlist and tracking metrics (KPIs). One can write their own netlists and agents to simulate whatever they like. The netlists directory has examples.

TokenSPICE Flow

Develop smart contract

Verify with TokenSPICE simulator

Deploy smart contract (as tx)

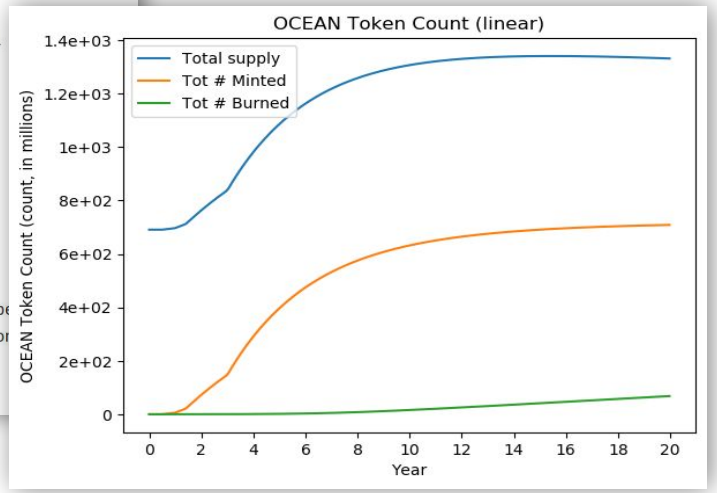



```
        uint spotPriceBefore = calcSpotPrice(
            inRecord.balance,
            inRecord.denorm,
            outRecord.balance,
            outRecord.denorm,
            _swapFee
        );
        require(spotPriceBefore <= maxPrice, 'ERR_BAD_LIMIT_PRICE');

        tokenAmountOut = calcOutGivenIn(
            inRecord.balance,
            inRecord.denorm,
            outRecord.balance,
            outRecord.denorm,
            tokenAmountIn
```

```
        new_agents.add(
            PublisherAgent(
                name="publisher",
                USD=0.0,
                OCEAN=self.ss.publisher_init_OCEAN,
                pub_ss=pub_ss,
            )
        )

        new_agents.add(
            DataconsumerAgent(
                name="consumer",
                USD=0.0,
                OCEAN=self.ss.consumer_init_OCEAN,
                s_between_buys=self.ss.consumer_s_be
                profit_margin_on_consume=self.ss.cor
            )
        )
```



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Data markets 1/2: Quick Intro to Ocean

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What is Ocean?

Ocean is...

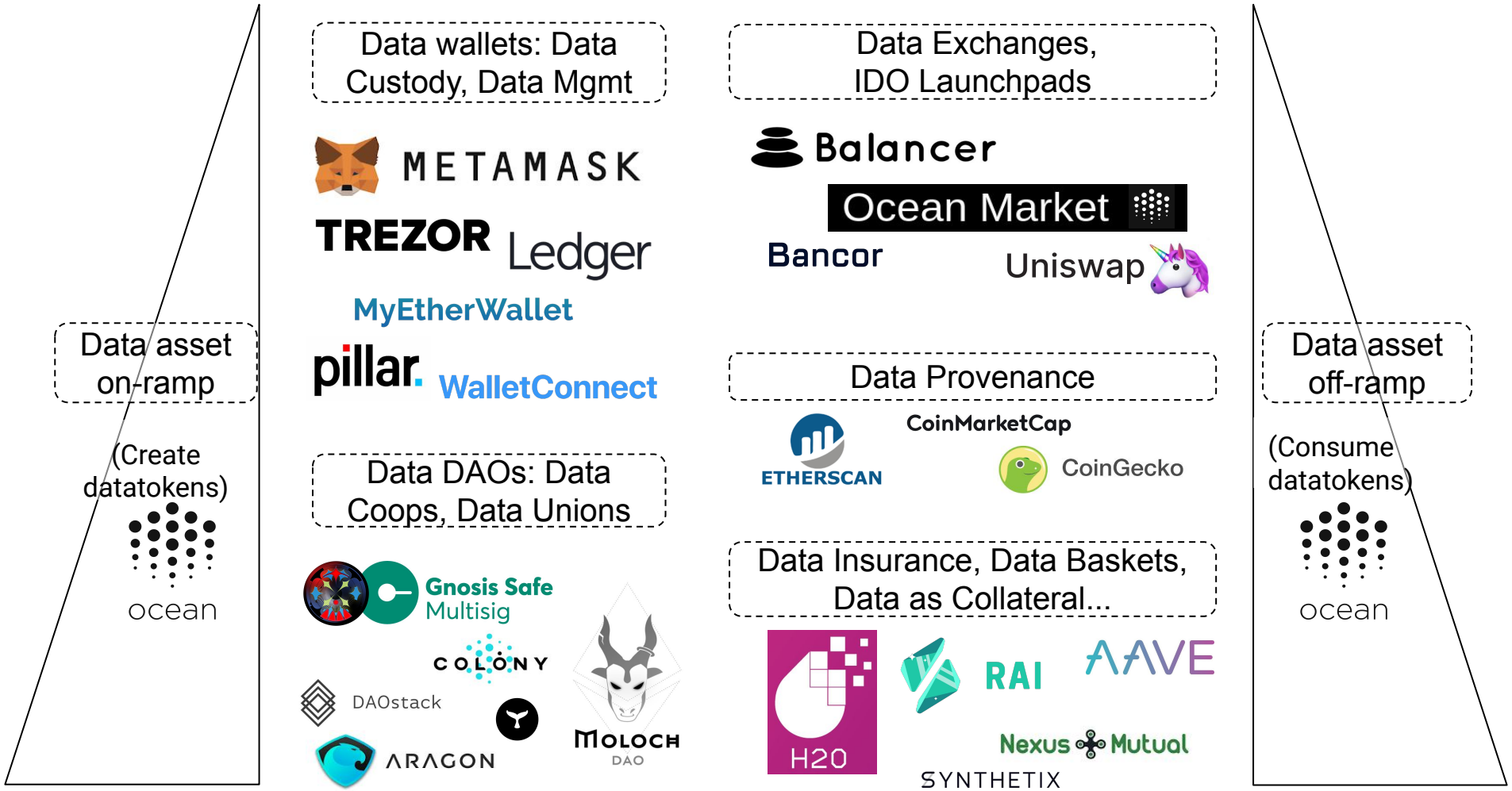
1. A **community** of individuals and orgs driving to the mission
2. A **token** (OCEAN) with incentives to grow & sustain the ecosystem
3. A **set of tools** as public infrastructure to facilitate the mission

Ocean Tools

- **Key principle:** datatokens
- **Ocean backend:** smart contracts + Py + JS. On Eth, Polygon, ..
- **Ocean Market:** dapp
- **OceanDAO:** grants program

Key principle: Ocean Datatokens

Ocean makes it easy to publish data services (deploy and mint ERC20 datatokens), and to consume data services (spend datatokens). Crypto wallets, exchanges, and DAOs become *data* wallets, exchanges, and DAOs.



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Ocean.py, js

Programmatically publish datatokens, data DEXes ..

https://github.com/oceanprotocol/ocean.py/blob/main/READMEs/datatokens-flow.md

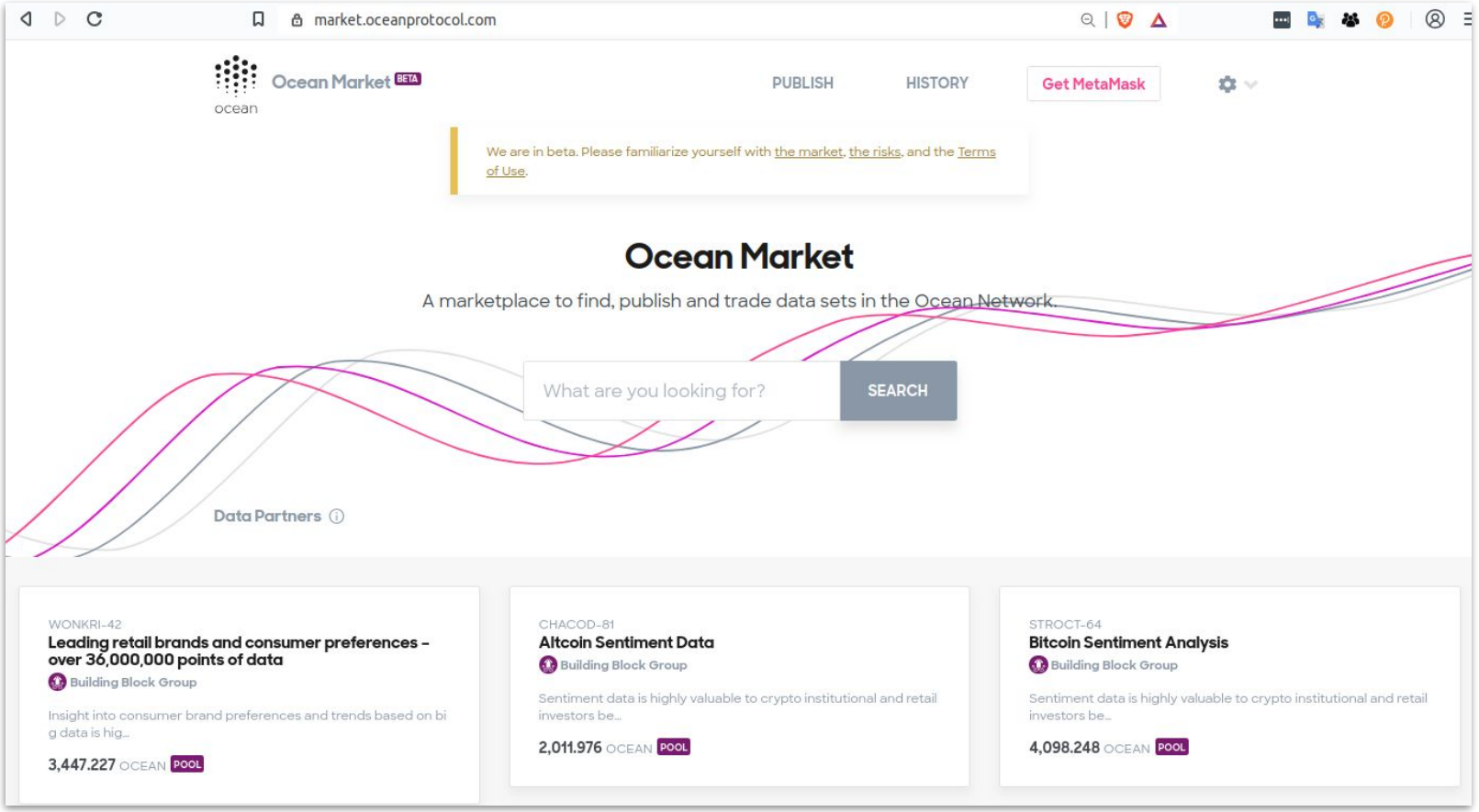
```
import os
from ocean_lib.example_config import ExampleConfig
from ocean_lib.ocean.ocean import Ocean
from ocean_lib.web3_internal.wallet import Wallet

private_key = os.getenv('TEST_PRIVATE_KEY1')
config = ExampleConfig.get_config()
ocean = Ocean(config)

print("create wallet: begin")
wallet = Wallet(ocean.web3, private_key, config.block_confirmations, config.transaction_timeout)
print(f"create wallet: done. Its address is {wallet.address}")

print("create datatoken: begin.")
datatoken = ocean.create_data_token("Dataset name", "dtsymbol", from_wallet=wallet)
print(f"created datatoken: done. Its address is {datatoken.address}")
```

Congrats, you've created your first Ocean datatoken!

Ocean Market

market.oceanprotocol.com

- Data on-ramp (publish)
- Data off-ramp (consume)
- DEX, for data



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OceanDAO Grants

$100K+ available per month. Anyone can apply

https://oceanprotocol.com/dao

Grant Proposal Template

Part 1 - Proposal Submission (*Mandatory)

Name of Project:

`_____(>=1 words)_____`

Proposal in one sentence:

`_____(1 sentence)_____`

Description of the project and what problem is it solving: (You can give more details in "proposal details" section farther down.)

`_____(1 paragraph)_____`

Grant Deliverables: (Target deliverables for the funding provided.)

- `__(Grant Deliverable 1)__`
- `__(Grant Deliverable 2)__`
- `__(Grant Deliverable 3)__`
- ...`

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Data markets 2/2
TE for data markets

Data Markets TE: Process

- Goals
- Design
- Implementation
- Verification

We'll use our experience with Ocean Protocol.

TE for Ocean Data Markets: Goals

- Drives health of $OCEAN: as mkt $ vol goes up, $OCEAN goes up
- Incentivizes people to “do work”, aka add value (more datasets, curation)
- Drives virality, i.e. incentivizes people to refer others to Ocean
- Basic design is simple to understand & communicate
- Each 3rd-party market can also get all the characteristics here. E.g. virality

TE for Ocean Data Markets: Design exploration

Many designs were explored against the criteria.

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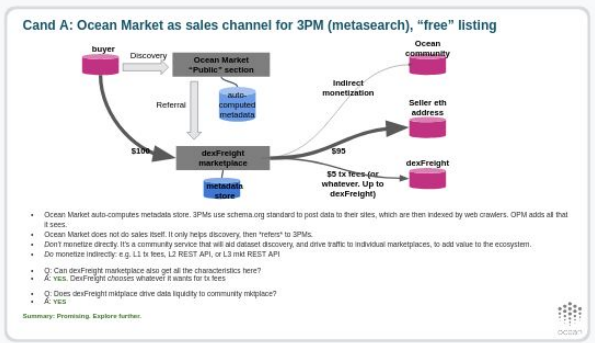

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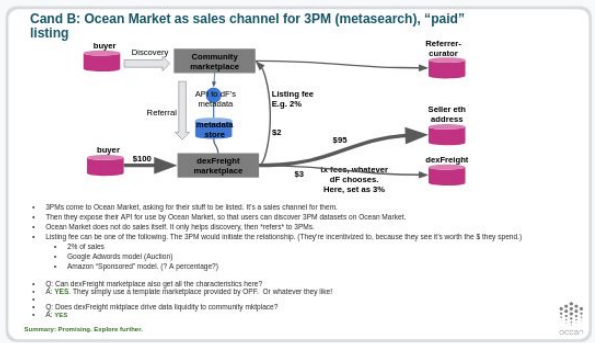

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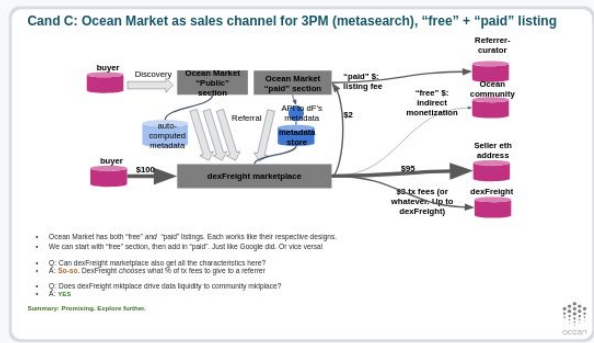

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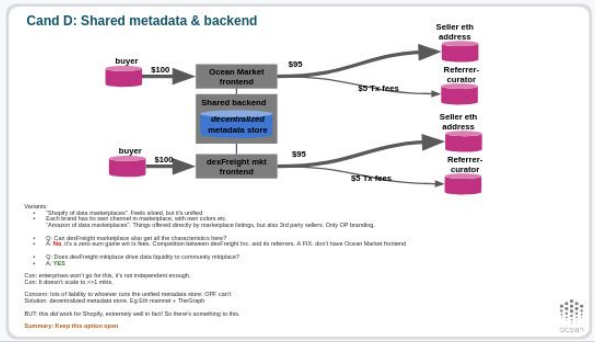

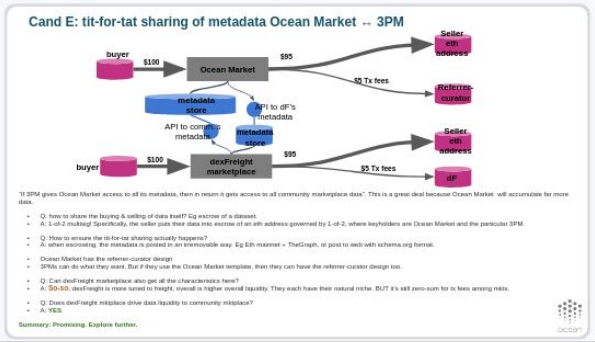

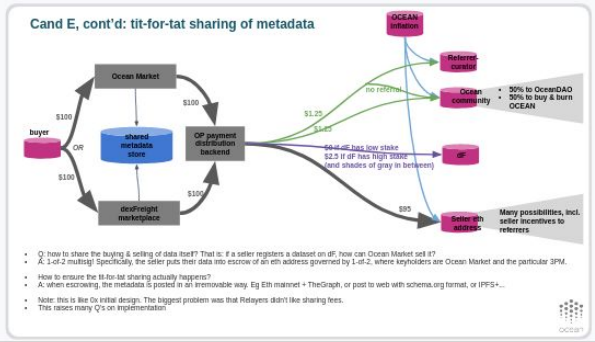

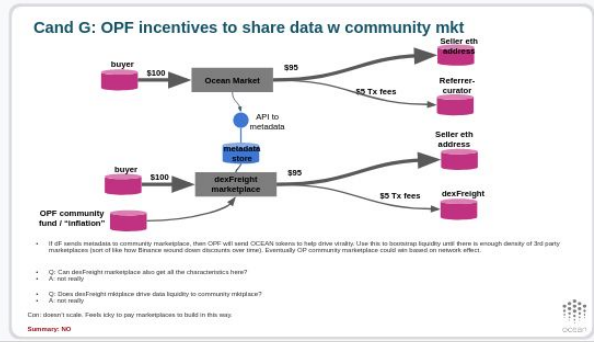

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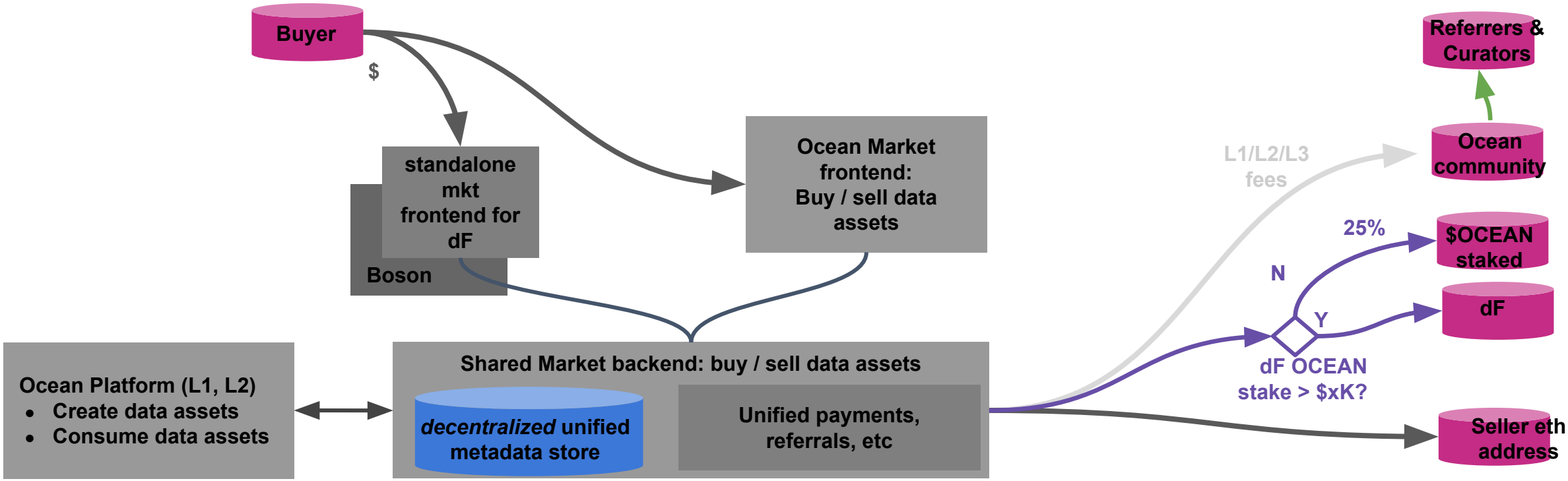
TE for Ocean Data Markets: Chosen design



- As $ volume goes up, it drives $OCEAN.
- Gets “work” and skin-in-the-game by curators, referrers, third-party marketplace owners
  - If you’re doing referrals and you drive volume↑, for more rewards you need stake↑
  - Same for curation

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TE for Ocean Data Markets: Implementation

A realization: AMMs implements the “Chosen TE design”, and meets “TE Goals”.

Details:

- Datatoken-OCEAN AMMs. LPing = staking = curating. LPs get a % of swap volume.
- Store metadata on-chain
- Deploy to Ethereum mainnet
- Datatoken consume() sends a % to marketplace runner, and to Ocean community

TE for Ocean Data Markets: Verification

1. **Humans**. Subjective discussions, with increasing # people. 1 →2 →key stakeholders
    - Discussions among team
    - Discussions with close collaborators (Fabric.vc, Balancer)

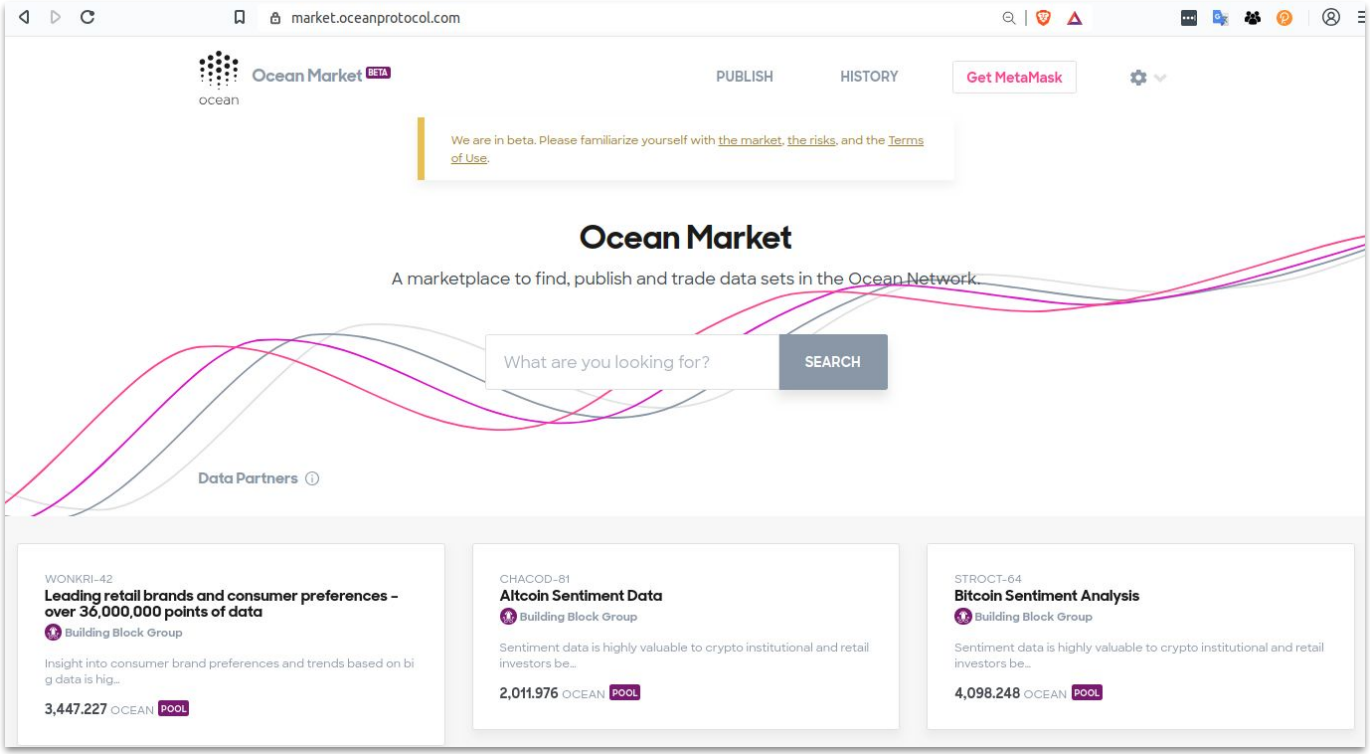
2. **Software**. Spreadsheet → agent-based sim
    - Built Py & JS drivers for Balancer, and make extensive unit tests
    - Did not do high-fidelity simulations of token dynamics. Why: (a) AMMs are already live (b) given the first point it wasn't worth the time commitment.

3. **Economic** (live). Can ratchet value-at-risk over time. People can choose risk/reward tradeoff.
    - Launched Ocean Market with lots of writings & caveats (e.g. "beta"). "Test in prod" ;)
    - People did choose risk/reward tradeoff. Some made $, some lost, some simply tested.
    - Observed community response to Ocean Market, and token dynamics.
    - Made adjustments accordingly. Being live was key to rapid improvements in what mattered.
    - Most notable TE adjustment: 10/90 OCEAN/DT → 50/50 → 70/30. It helped a lot.
    - Further TE improvements identified around "Safer Staking / Better IDOs". (Built in next version)

TE For Data Markets: Result: Ocean Market

https://market.oceanprotocol.com

- It's a decentralized exchange (DEX), tuned for data.
- Webapp + datatokens + AMMs (Balancer)
- Actions: publish data, buy, sell, consume, stake



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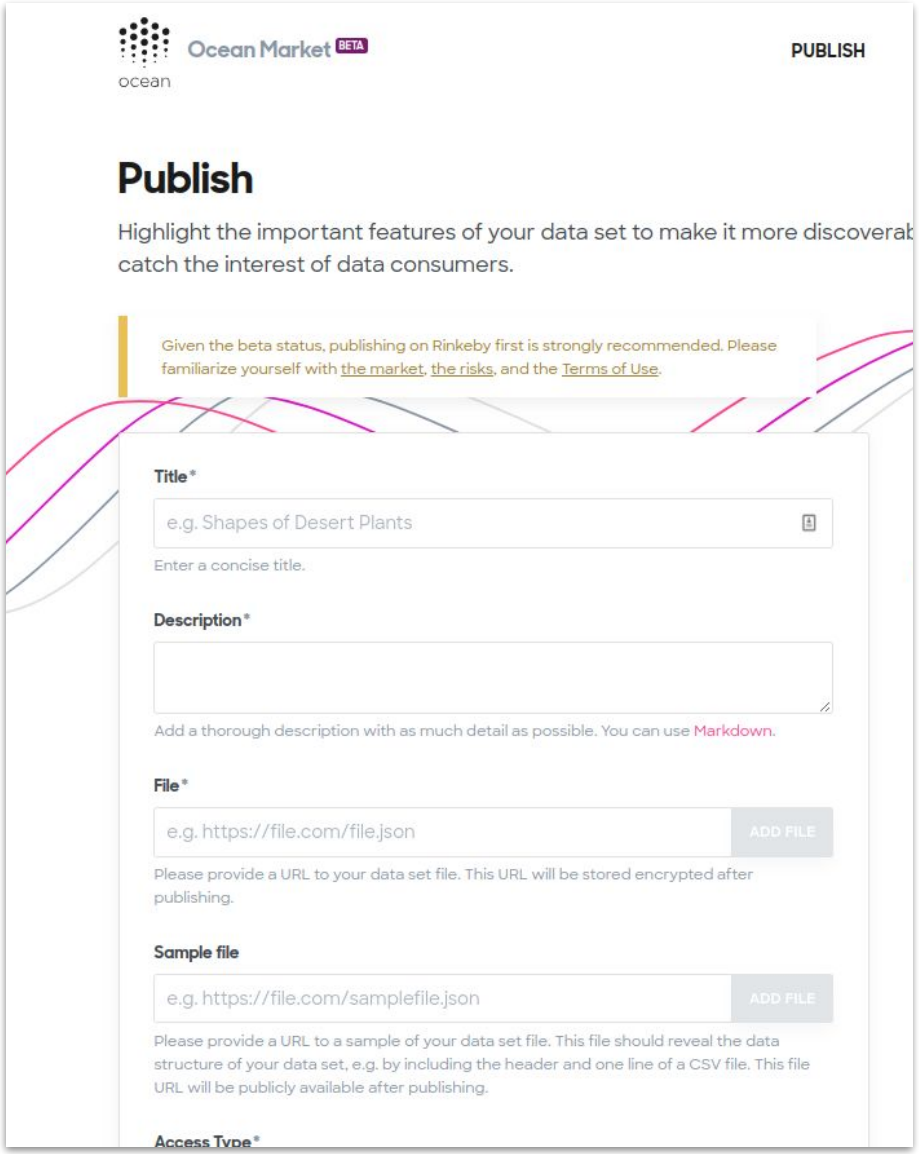
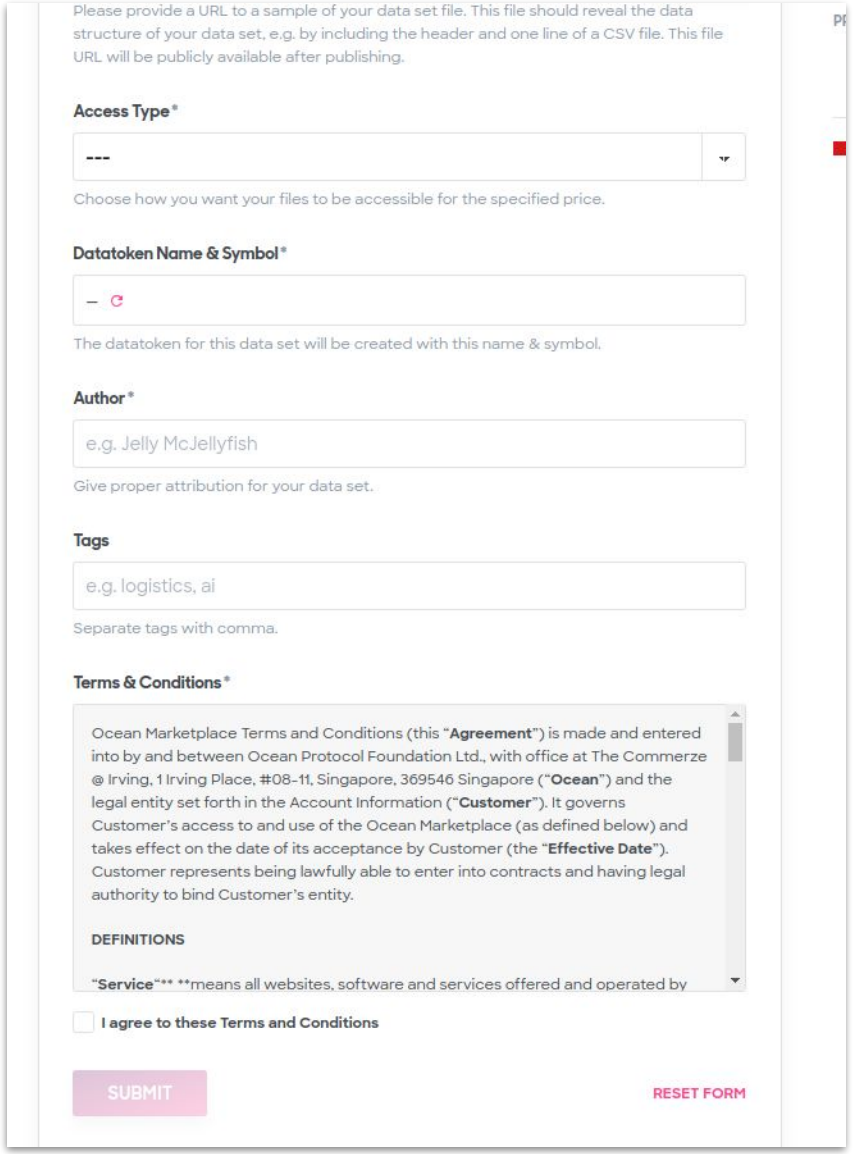
Live Example: Ocean Market: Dataset Publish Flow

https://market.oceanprotocol.com/publish





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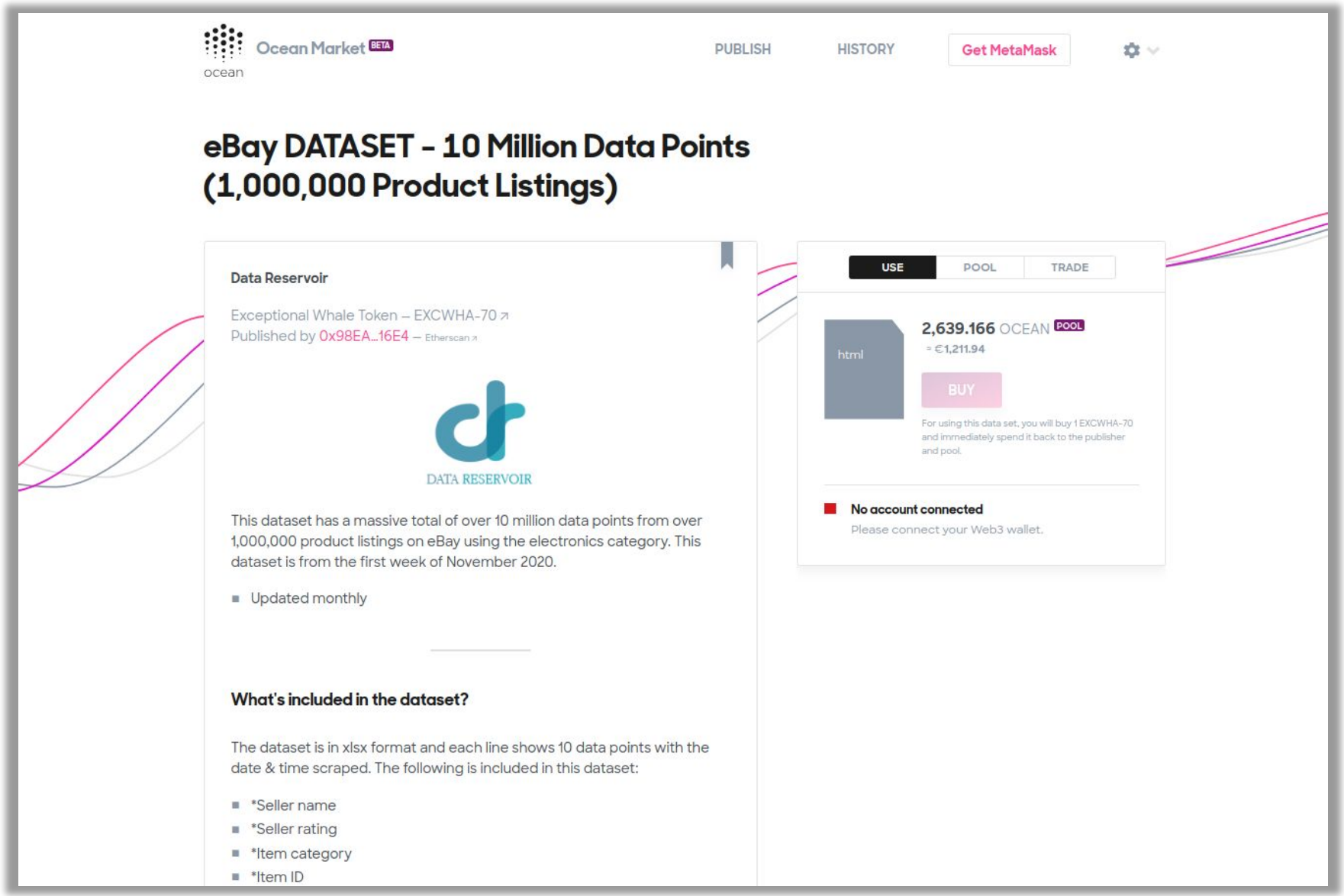
Live Example Data Asset: Fixed Pricing (eBay data)



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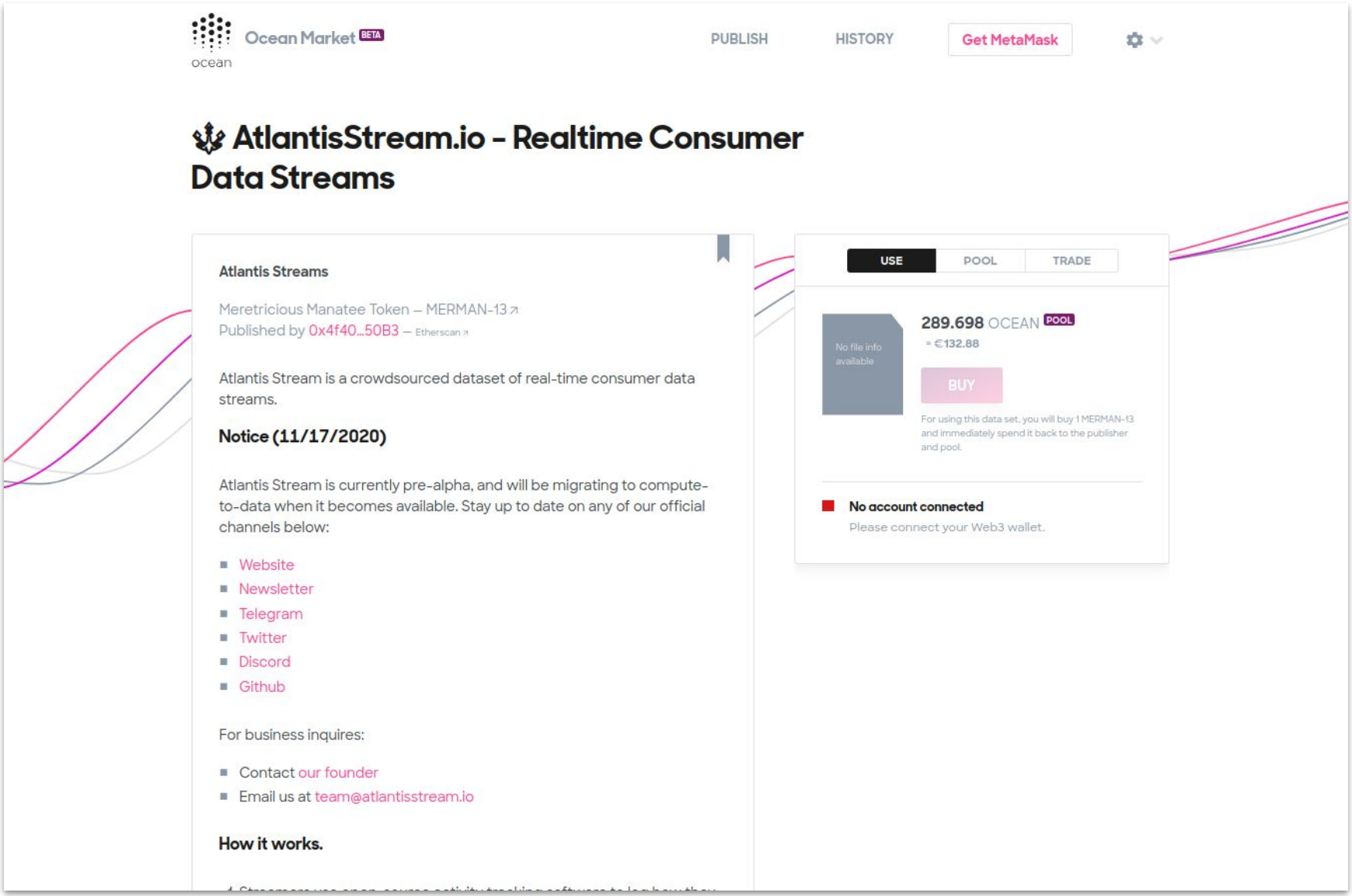
Live Example Data Asset: Dynamic Pricing (Consumer Data Streams)



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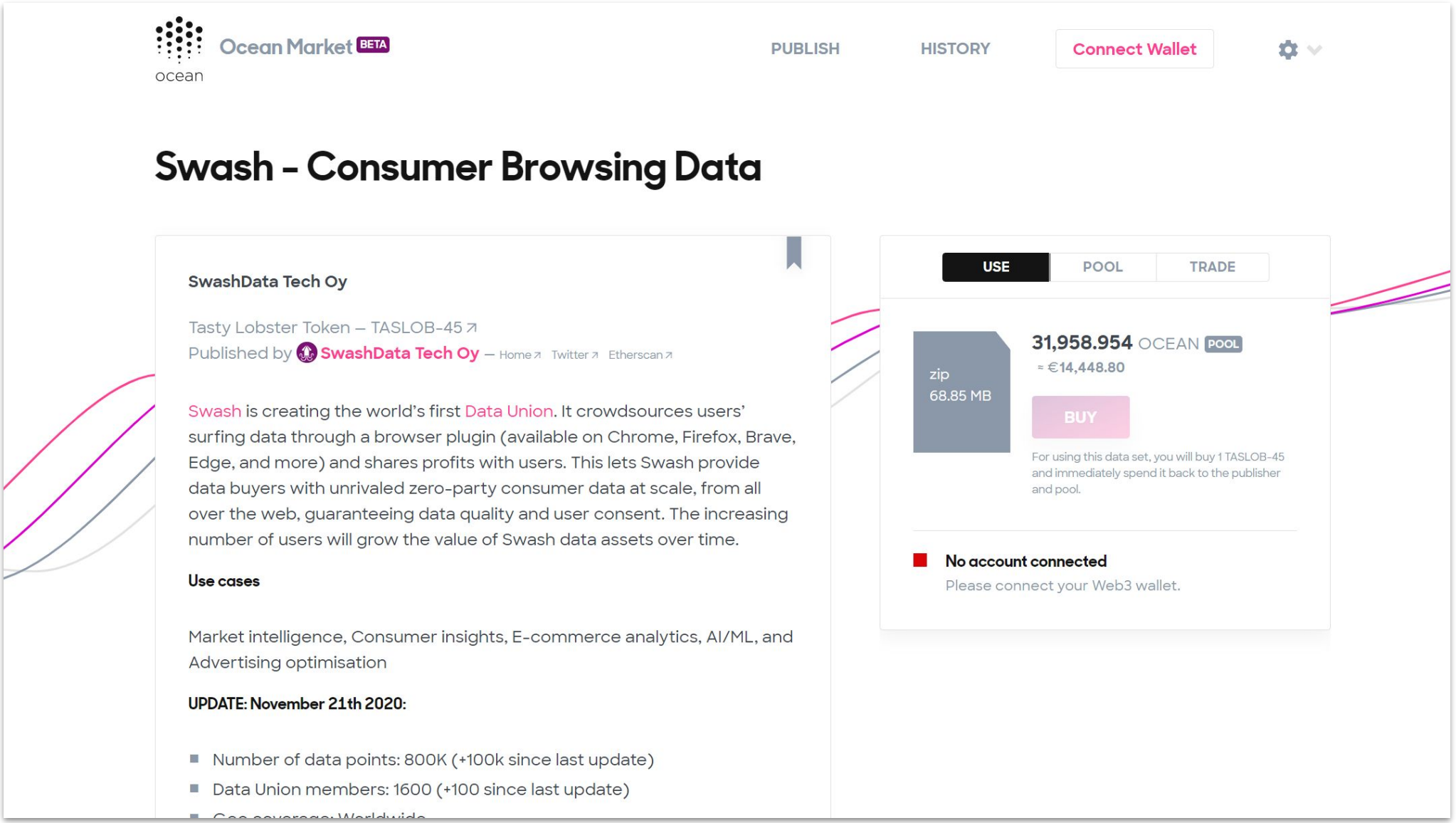
Example Data Asset: A Data Union (Swash)



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Live Example Data Indexes for Ocean Market

Quality Metrics from the Community, Free & For Sale

Tokens: 524 OCEAN Price: $0.42 OCEAN Market Cap: $148,650,190.67 Tokens Volume (24h): $49,836,028.19 (49,836,028.193 OCEAN) To

Data Market Cap

powered by ocean

Today's Token Prices by Market Cap

The global OCEAN market cap is **$30,449,817.34**, a 9.8% change over the last day.

Page 1 Search for tokens

Name	Price	Market Cap	Volume (24h)	Circulating Supply	Tags
Intransigent Fugu Token INTFUG-26	$9,998.00	$9,998,000.00	**$9,998,000.00** 1,000 INTFUG-26	1,000 INTFUG-26	location-data-uk-driving
Sclerotic Eel Token SCLEEL-38	$3,115.00	$3,115,000.00	**$0.00** 0 SCLEEL-38		
Jocular Clam Token JOCCLA-51	$2,100.00	$2,100,000.00	**$0.00** 0 JOCCLA-51		

rugpullindex.com

The first decentralized data set index in the world.

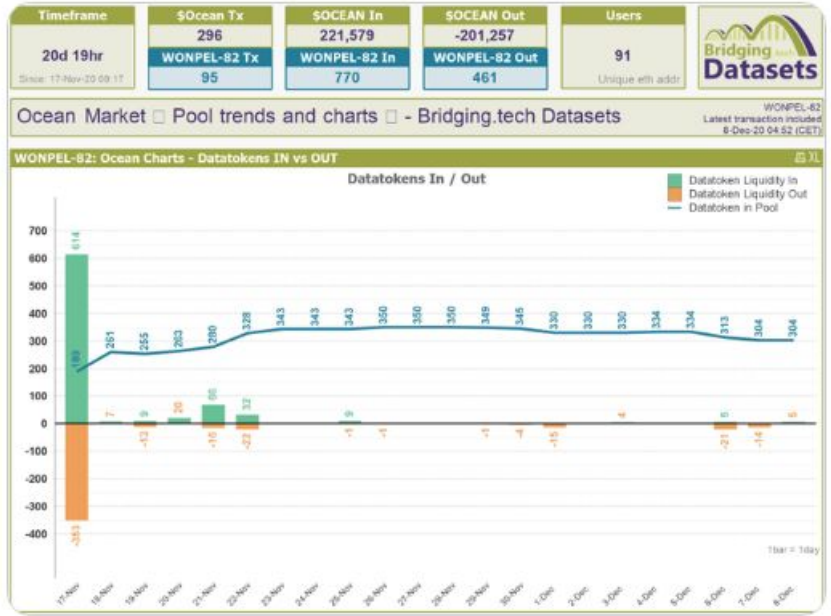
Last updated on 2020/12/11 *(updated every day at midnight)*

# (1d Δ)	Symbol	Score	Gini	Liquidity (OCEAN)	Price (OCEAN)	
1 0	QUICRA-0	16.60	0.93	554,838	498.85	LP
2 0	TREPEL-36	5.73	0.70	44,219	91.03	LP
3 0	MERMAN-13	5.11	0.86	82,213	187.29	LP
4 0	TASLOB-45	3.01	0.88	57,053	33,500.49	LP
5 0	LUMSTA-42	2.13	0.97	150,159	33,270.58	LPs Trade

Bridging.tech Datasets
@BDatasets

Check out this datatoken overview of our datapool: Ocean Market 🌊 Pool trends and charts 📈

Price to buy increased to 29 $ocean because in the last 2 days around 30 'WONPEL-82' were traded out (not bought).



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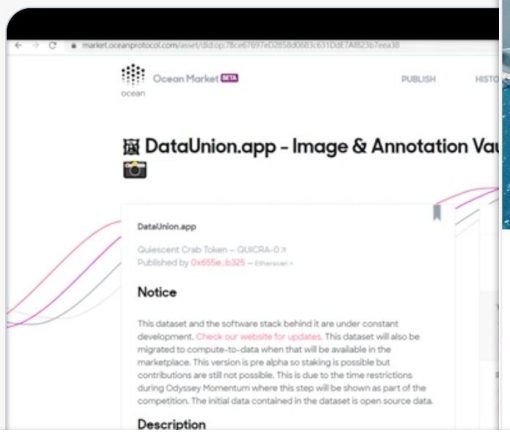
Live Example Data Ecosystem

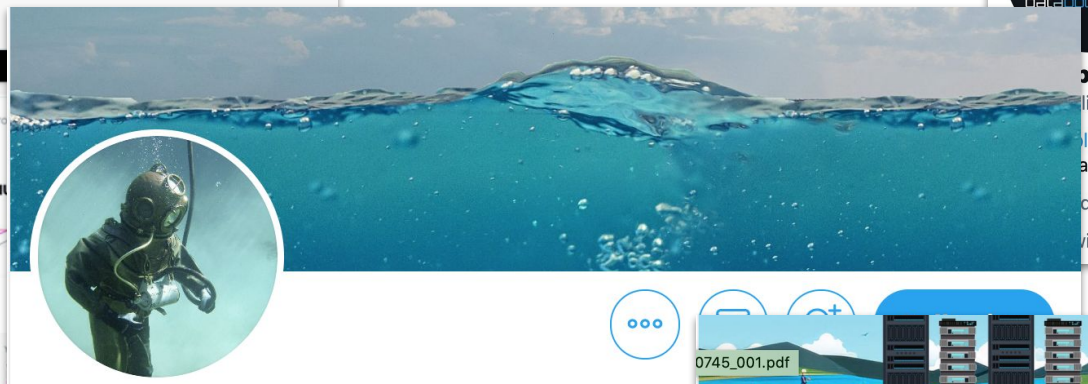
Several startups launched in first mo. Now, >25 teams

DataUnion.App @DataunionA · Nov 15

There is a first review on YouTube about the dataset:
youtu.be/CtETKKnx1fk
Thank you for that @profit_ai

#OceanProtocol





|opendata| Data Brokers
@databrokers1 Follows you

re treasures

103E2ef5Ab

datawhale @realdatawhale · Nov 25

Our proprietary staking rating formula for "Directory" will be based on metrics that don't lie: numbers.

The highest weightage for the rating will be based on number of sales, number of transactions & decentralization.

Our TREPEL-36 sold more than all top pools combined

Dataset-Title	Datatoken-Ticker	Datatoken-Supply	Average 7-Day Liquidity	Number of Sales	Number of Contract Txs	Number of Token Transfers	Total Token Holders	GINI Index (via nugusf/index.com)
Ocean Marketplace Directory & Pool Ratings	TREPEL-36	500	146,956	50	6,216	265	854	0.72
Swash - Consumer Browsing Data	TASLDB-45	20	135,348	-	8,432	54	1,182	0.87
Product Pages of 1'044'709 Products on Amazon.com (processed data)	LUMSTA-42	50	138,994	-	2,027	45	525	0.97
Leading retail brands and consumer preferences – over 36,000,000 points of data	WONKRI-42	20	63,551	-	2,136	14	541	0.85
PVLACE 808 Mafia Melody Compositions / Samples	IRXCOR-52	60	35,330	2	851	19	230	0.98
eBay DATASET - 10 Million Data Points (1,000,000 Product Listings)	EXCWHA-70	9	41,085	-	498	6	152	0.94
Altcoin Sentiment Data	CHACOD-81	20	29,506	1	1,704	20	467	0.84
Bitcoin Sentiment Analysis	STROCT-64	9	33,010	-	810	5	262	0.93
DataUnion.app - Image & Annotation Vault	QUICRA-0	1,000	641,256	-	595	65	172	0.90
AtlantisStream.io - Realtime Consumer Data Streams	MERMAN-13	857	168,500	4	743	215	154	0.88
Oceancap - Datapool Evaluation and Charting	ADASTA-60	997	80,783	13	1,167	122	150	0.94
Pool trends and charts	WONPEL-82	535	35,682	5	299	92	66	

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lications we strive to provide businesses & researchers with high quality,
ata that facilitates new market insights, & drives innovation.
d November 2020
ving **27** Followers

Data Reservoir
@DataReservoir Follows you

Provider of valuable datasets on the Ocean Marketplace.

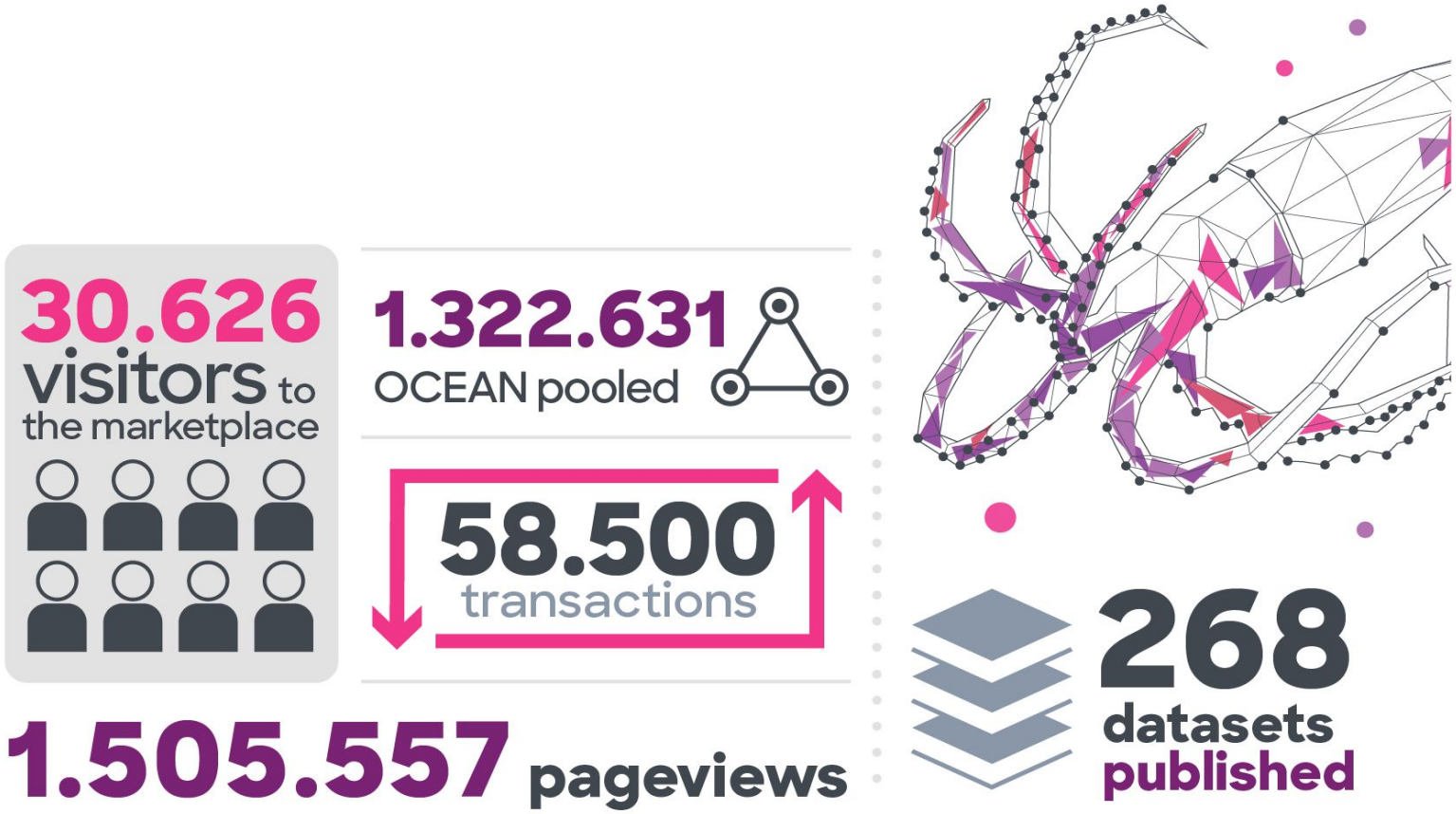
Joined November 2020

70 Following **329** Followers

ocean

Live Example: Ocean Market Stats After First Month

(Six months later, it's about 3x the numbers shown)



164 dataset pools

ocean

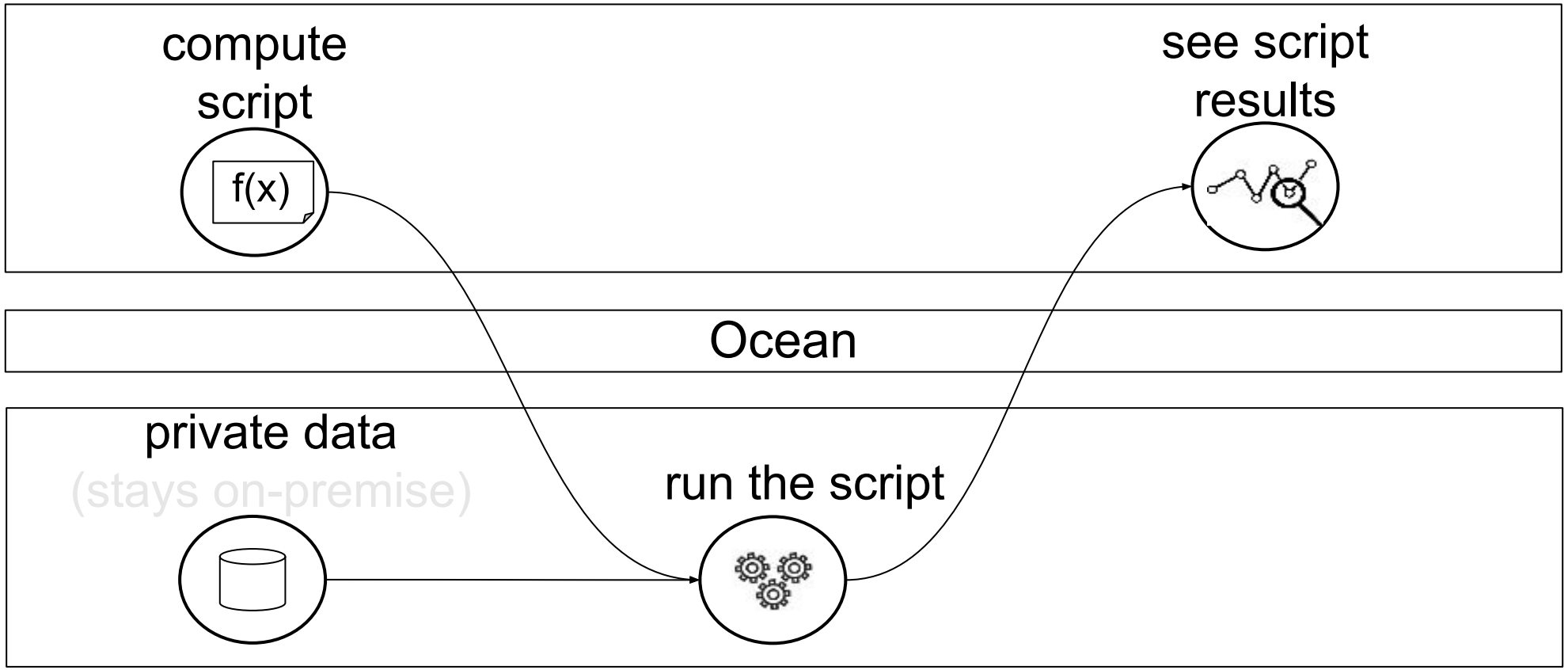
Data Services: “Static Uri” Service

- Publisher encrypts the uri
- Uri gets decrypted upon ‘consume’
- Available in backend and frontend (Ocean Market)

- Works for...
  - static files
  - dynamically-updated files
  - http & Web2 REST APIs
  - IPFS uris
  - and more. Super-flexible.

Data Services: Compute-to-Data Data Service

Buy & sell private data, while preserving privacy



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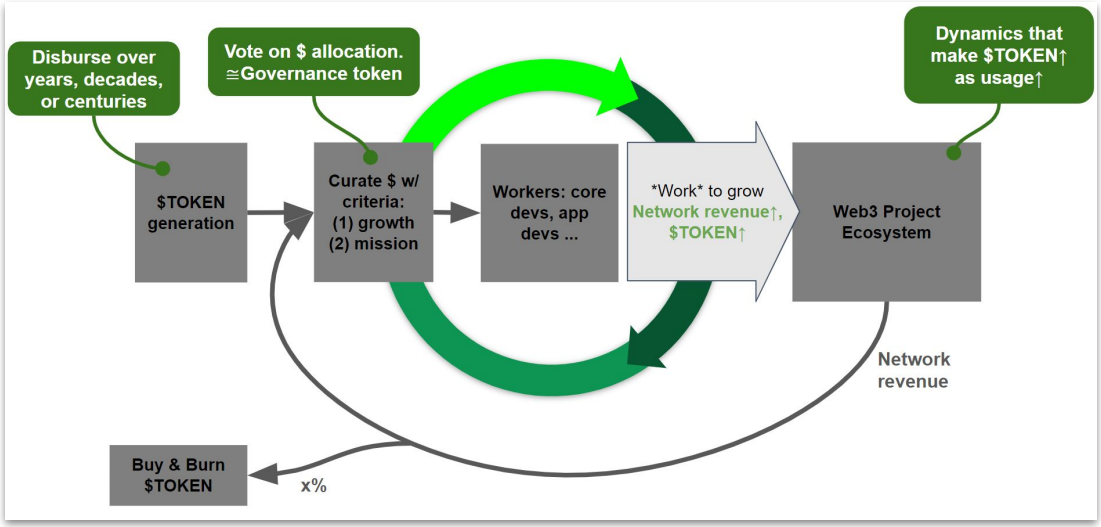
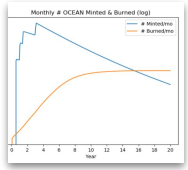
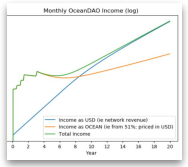
Conclusion

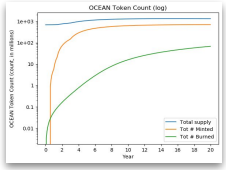
Conclusion

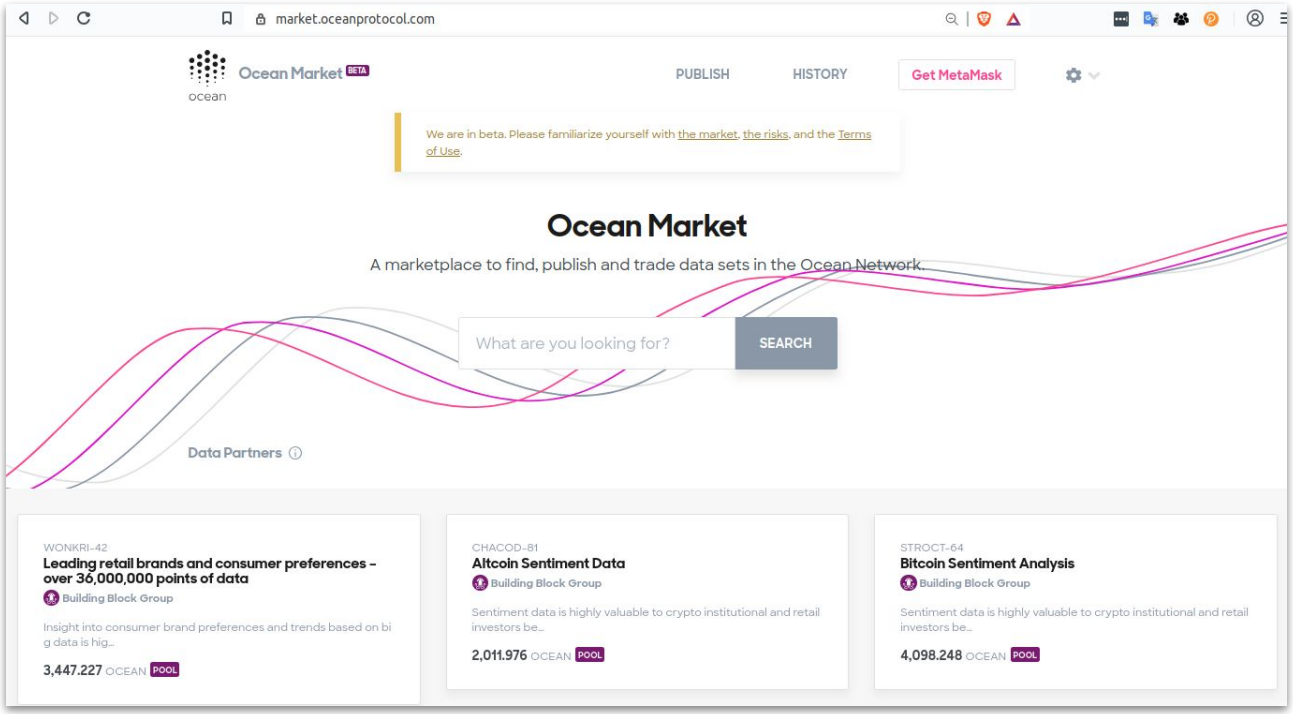
- Intro to TE
- TE for ecosystem sustainability – Web3 Sustainability Loop
- TE for data markets – with live example Ocean Market











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