GAIA-X and the Web3 Sustainability Loop

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GAIA-X, Aug 30, 2021
Slides: http://trent.st/content/gaiax-wsloop.pdf

@trentmc0 @oceanprotocol

GAIA-X is getting built. 👍

Now, how can GAIA-X
be self-sustaining over the decades?

GAIA-X Sustainability Goals

Here's the challenge.

Find a design to enable...

- GAIA-X ecosystem *sustainable and growing*, towards *ubiquity*
- Funding goes to teams writing code, doing outreach, over the long term (decades)
- GAIA-X funding grows as usage of network grows

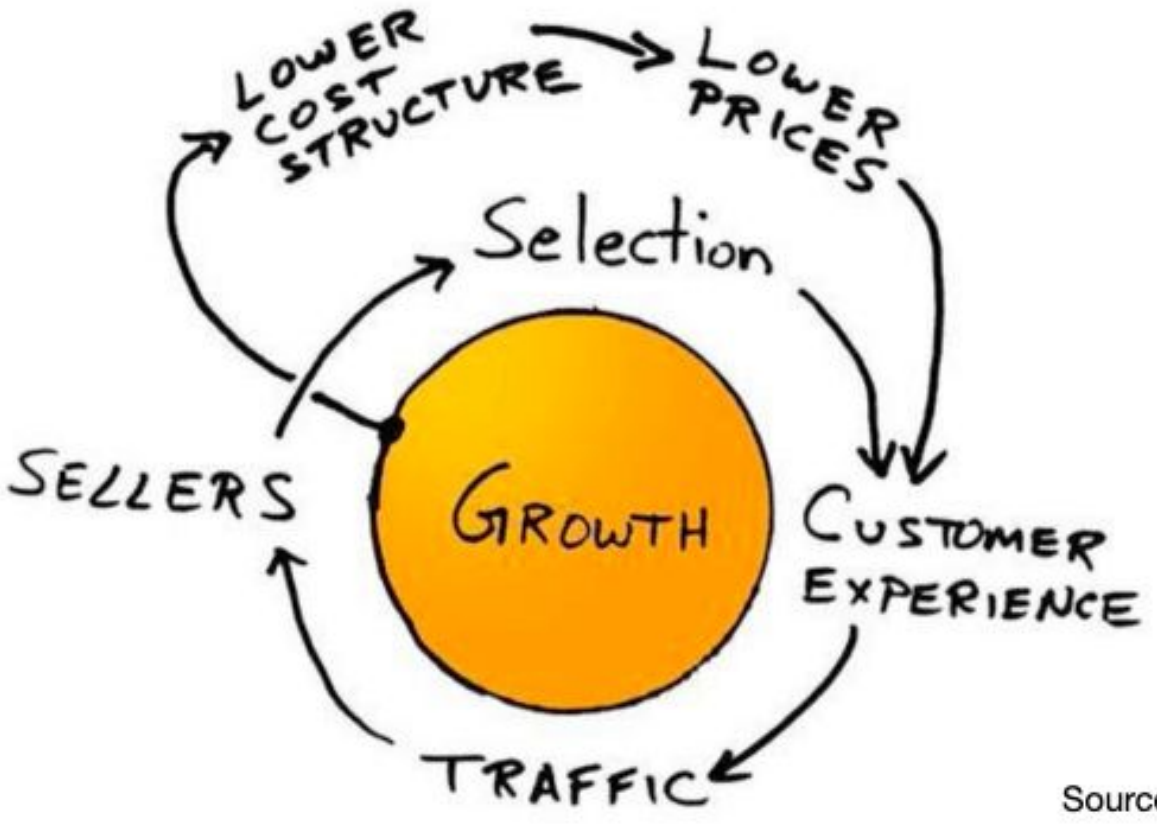
Including:

- 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.

From Amazon to Web3 Sustainability

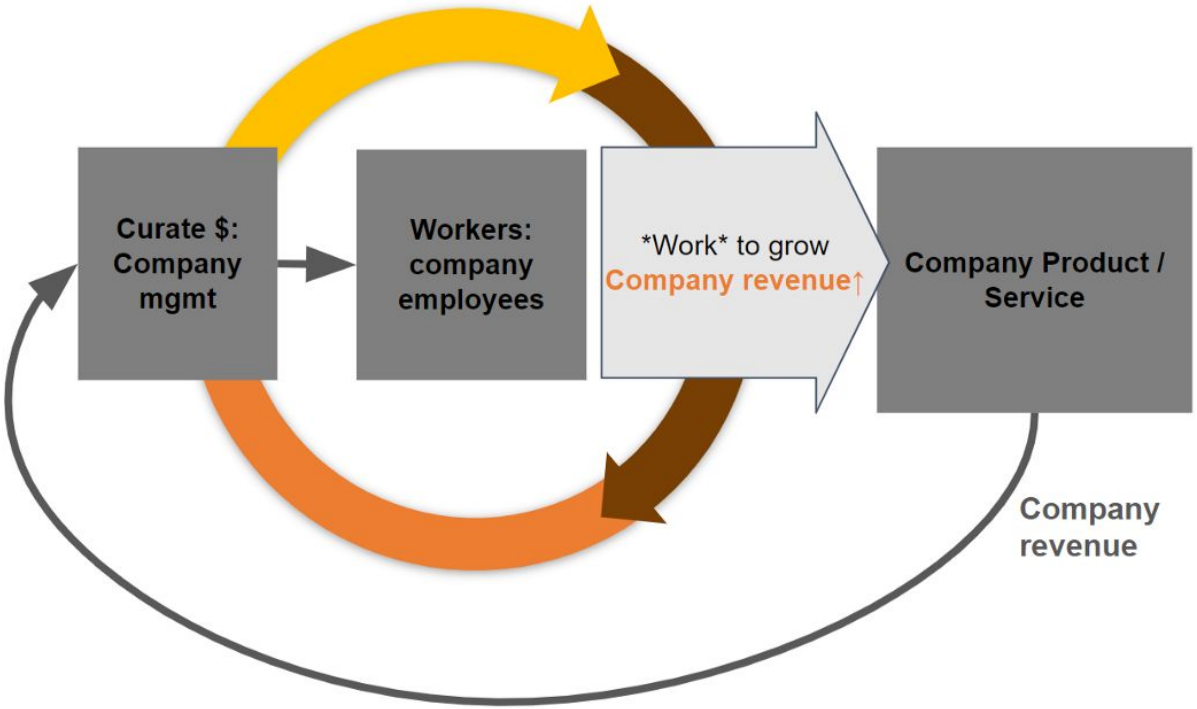
How does Amazon work?



Source: Amazon

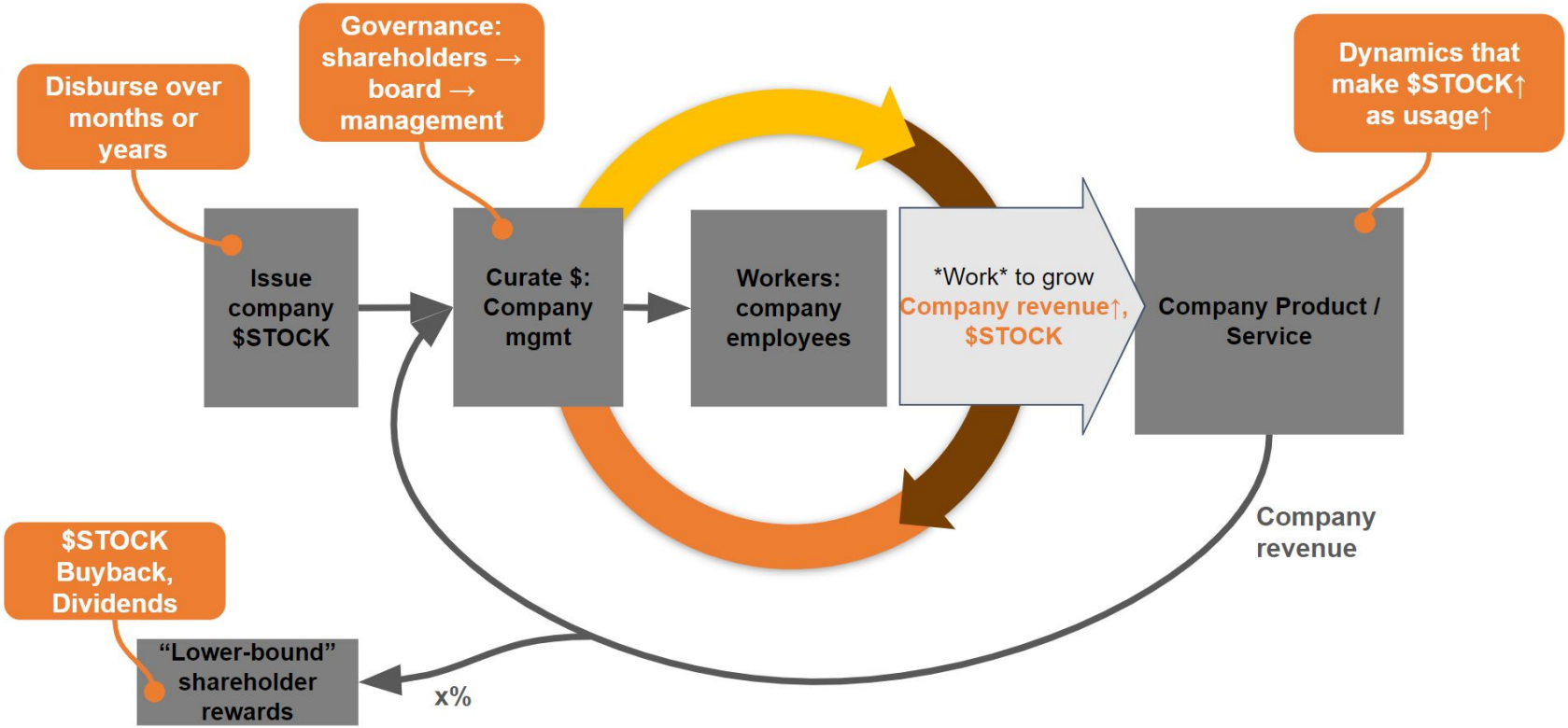
Company business model with a focus on revenue

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



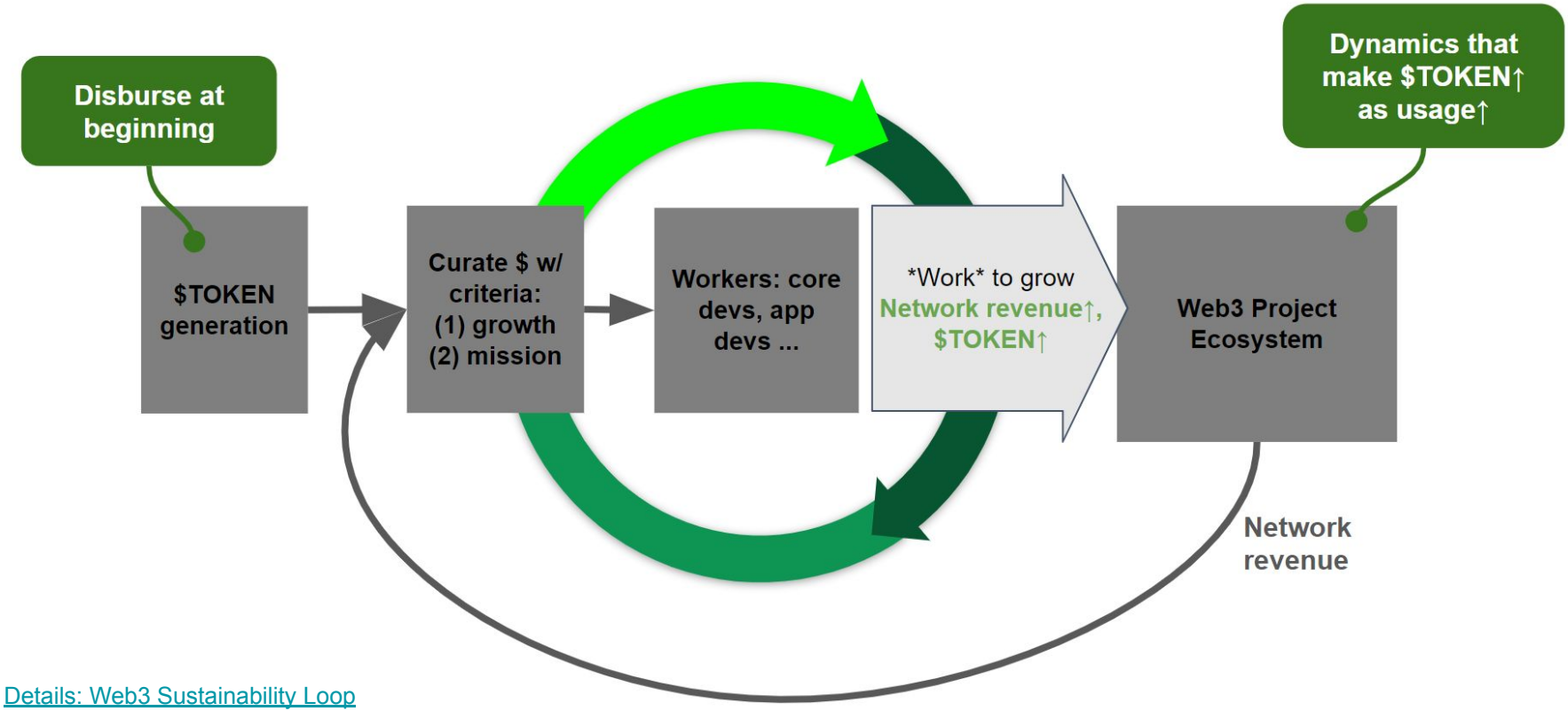
Company business model - full picture

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



Web3 Model with a focus on revenue

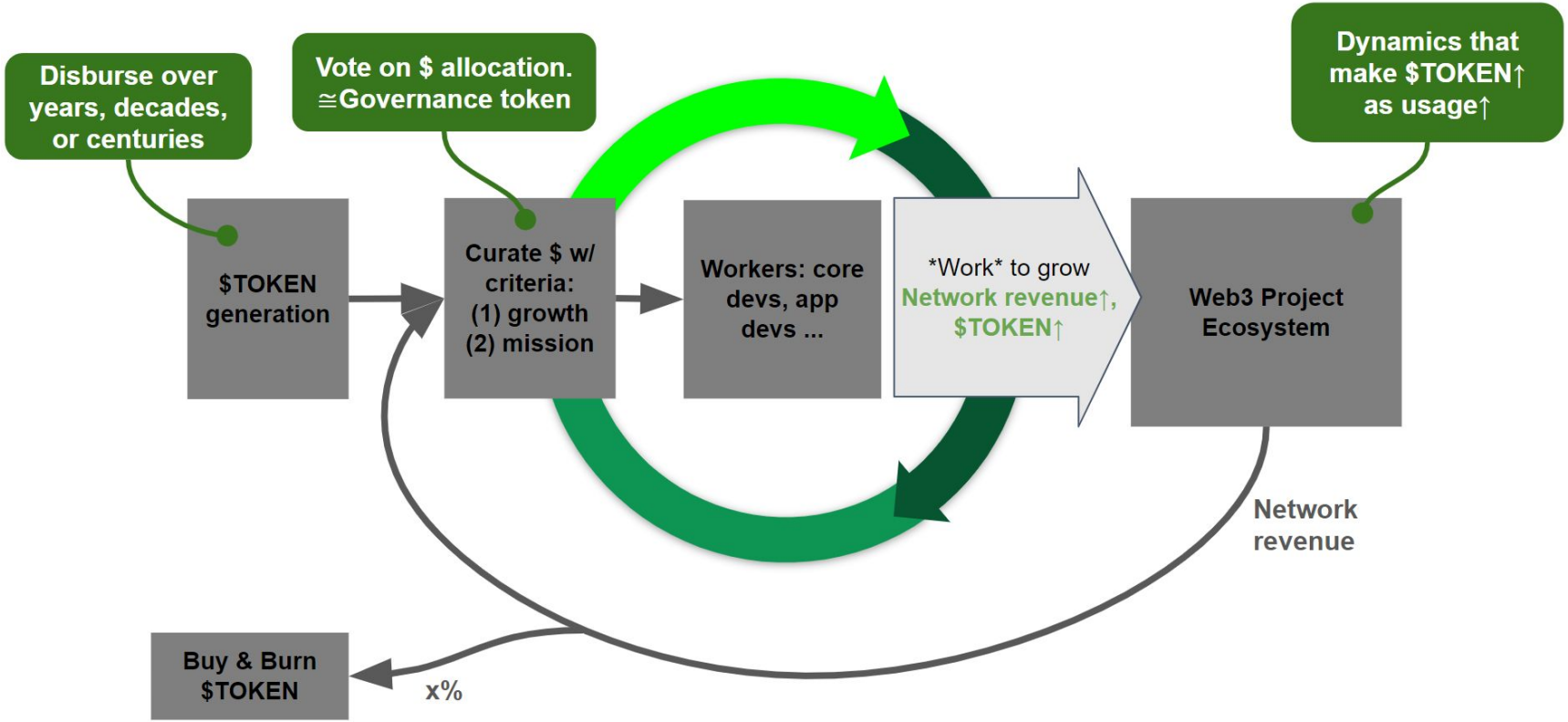
But, challenges: how to kickstart the project, how to catalyze growth



Details: Web3 Sustainability Loop

The Web3 Sustainability Loop

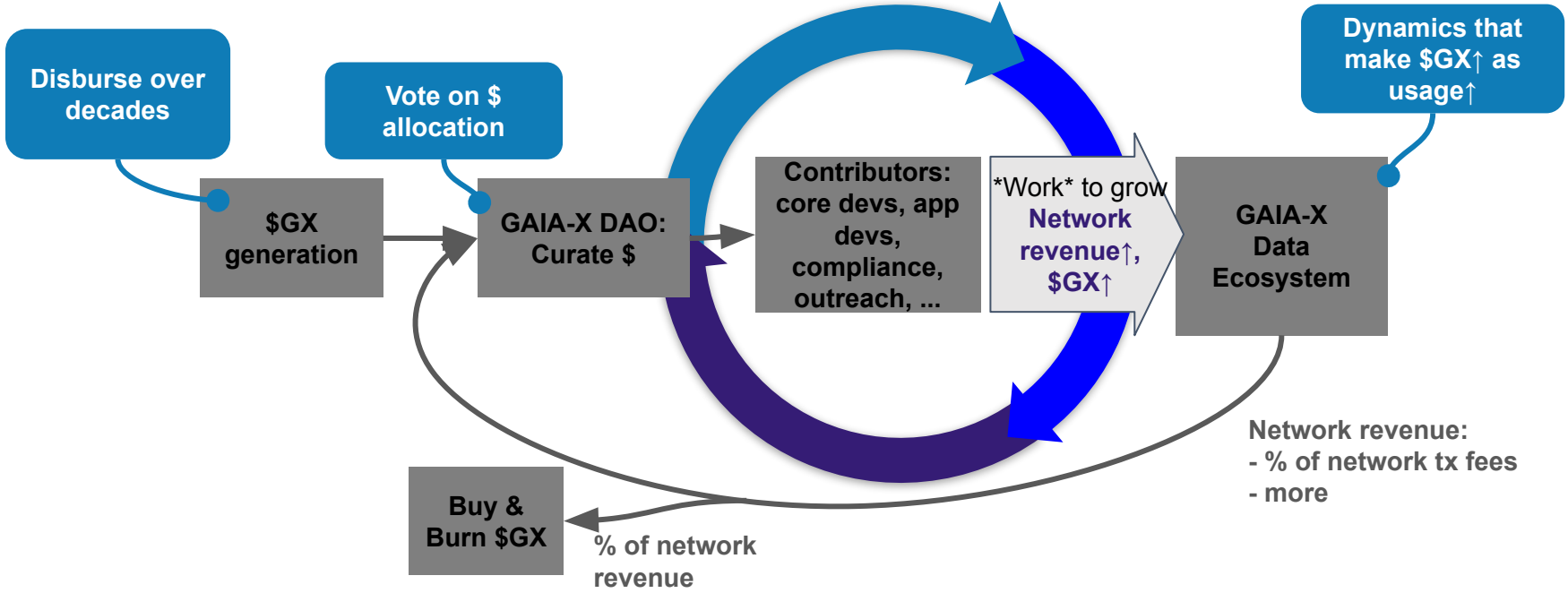
Has an “outer wrapper” that uses tokens as a tool, in addition to revenue



Details: Web3 Sustainability Loop

GAIA-X Sustainability Loop

Revenue for long-term sustainability, GX token to catalyze it

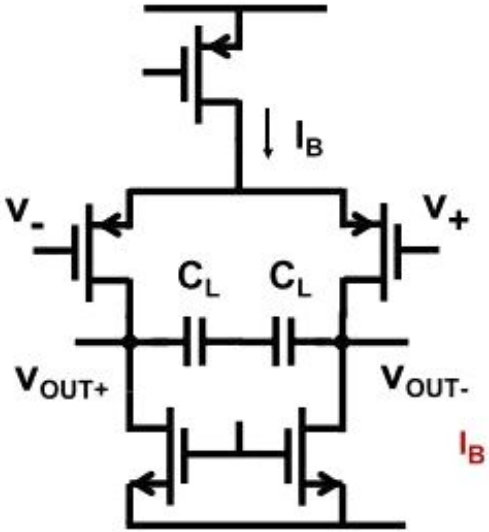


Details: Web3 Sustainability Loop

Will it work?
How do we verify the design?

Verification in Electrical Engineering

Pure Manual Analog Circuit Design



$$GBW = \frac{g_{m1}}{2\pi C_L} \qquad g_{m1} = \frac{I_B}{V_{GS1}-V_T}$$

$$GBW_{max} = \frac{I_B}{V_{GS1}-V_T} \frac{1}{2\pi C_L}$$

0.2 V

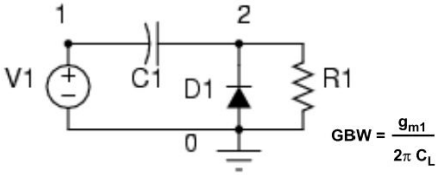
$I_B = 10\ \mu A \quad C_L = 1\ pF \quad GBW_{max} \approx 10\ MHz$ [8]

$$FOM = \frac{GBW.C_L}{I_B} = 1000\ \text{MHzpF/mA}\ [800]$$

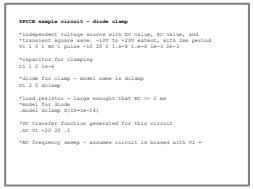
https://www.yumpu.com/en/document/read/8605920/systematic-design-of-operational-amplifiers-springer

SPICE workflow

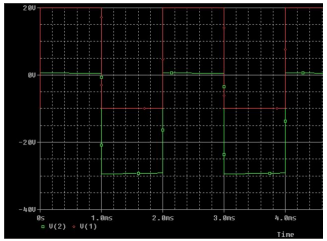
Manual design



Enter netlist (schematic editor, or write)

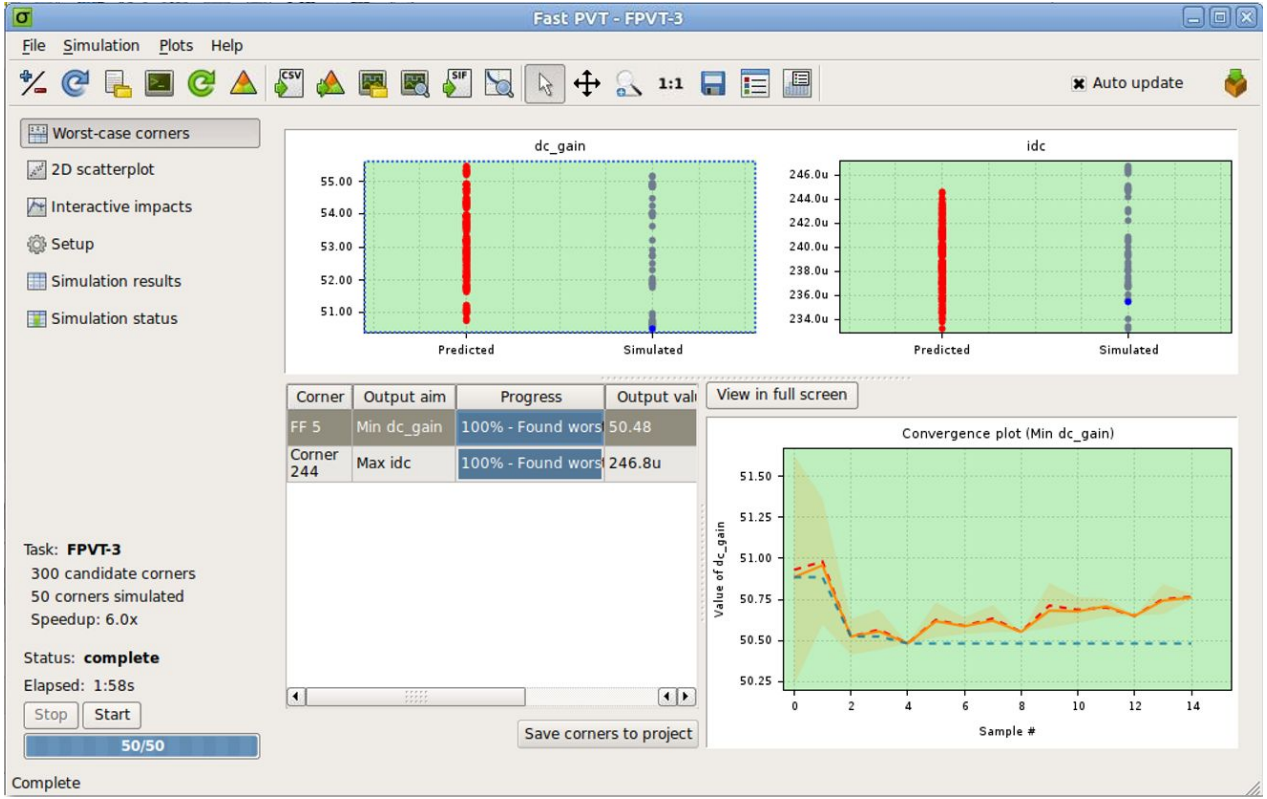


Run SPICE



Example: Verification with SPICE

Solido Fast PVT: Worst-case analysis via global optimization



Verification in Token Engineering

How To Verify

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 → **simulation**
3. **Economic (live)**. Can ratchet value-at-risk over time. People can choose risk/reward tradeoff. Phased approach.

Let's focus on simulation here...

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

TokenSPICE

https://github.com/tokenspice/tokenspice

TokenSPICE: EVM Agent-Based Token Simulator

TokenSPICE can be used to help design, tune, and verify tokenized ecosystems in an overall Token Engineering (TE) flow.

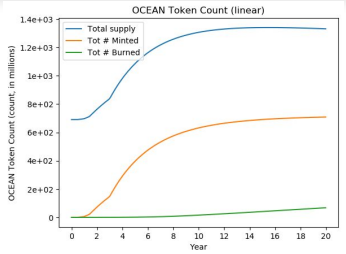
TokenSPICE simulates tokenized ecosystems using an agent-based approach.

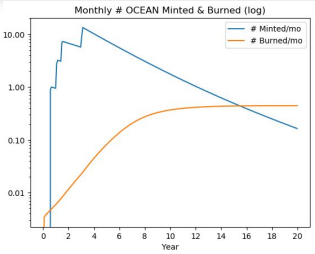
Each “agent” is a class. Has a wallet, and does work to earn $. One models the system by wiring up agents, and tracking metrics (kpis). Agents may be written in pure Python, or with an EVM-based backend. (The original version was pure Python. This repo supersedes the original.)

It's currently tuned to model Ocean Market. The original version was tuned for the Web3 Sustainability Loop. However you can rewire the "netlist" of "agents" to simulate whatever you like. Simply fork it and get going.

TokenSPICE was meant to be simple. It definitely makes no claims on "best" for anything. Maybe you'll find it useful.

Documentation.



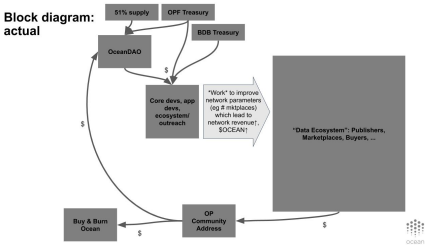


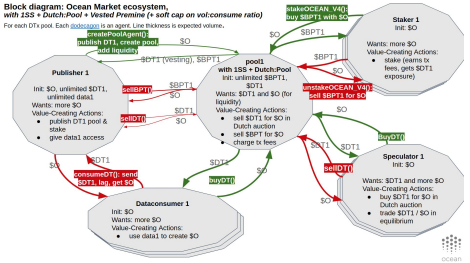
TokenSPICE workflow

Manual design

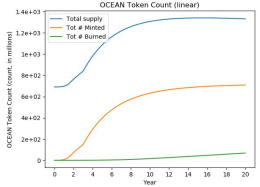
Enter netlist (schematic editor, or write)

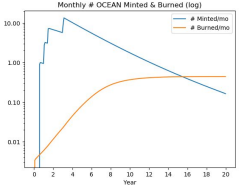
Run TokenSPICE





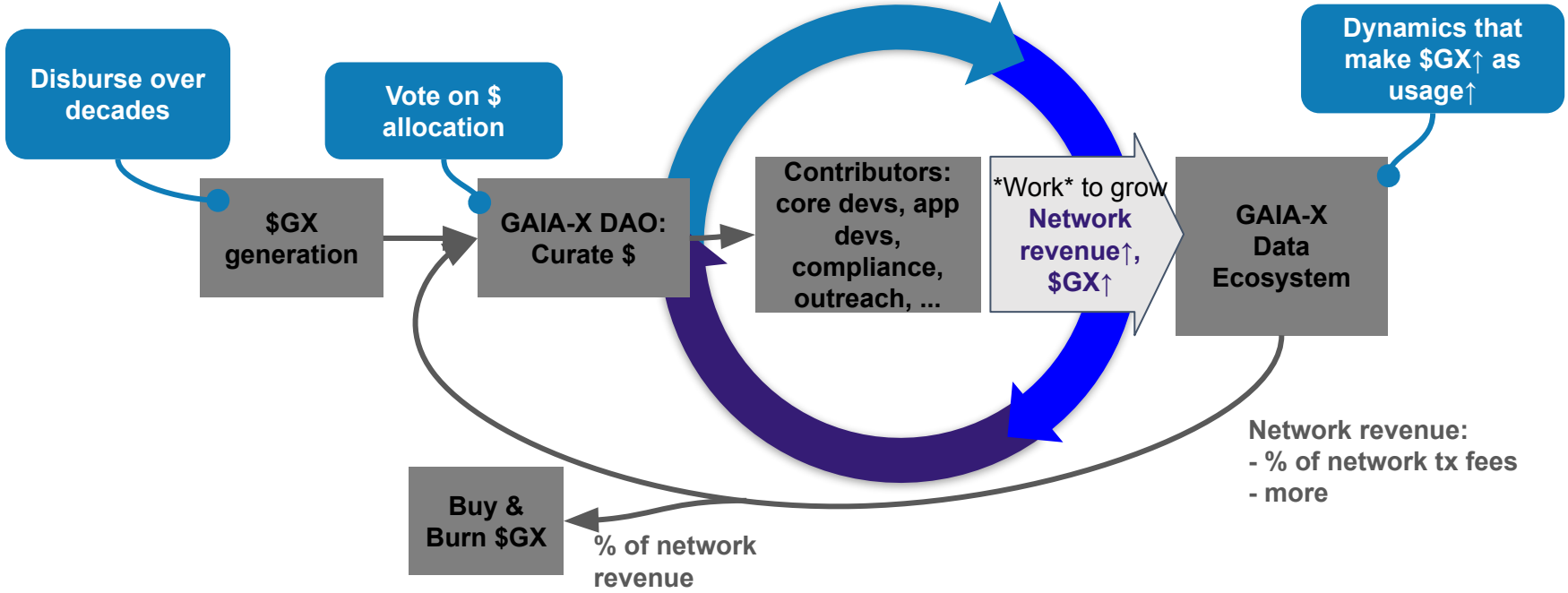
Python + Solidity (EVM)





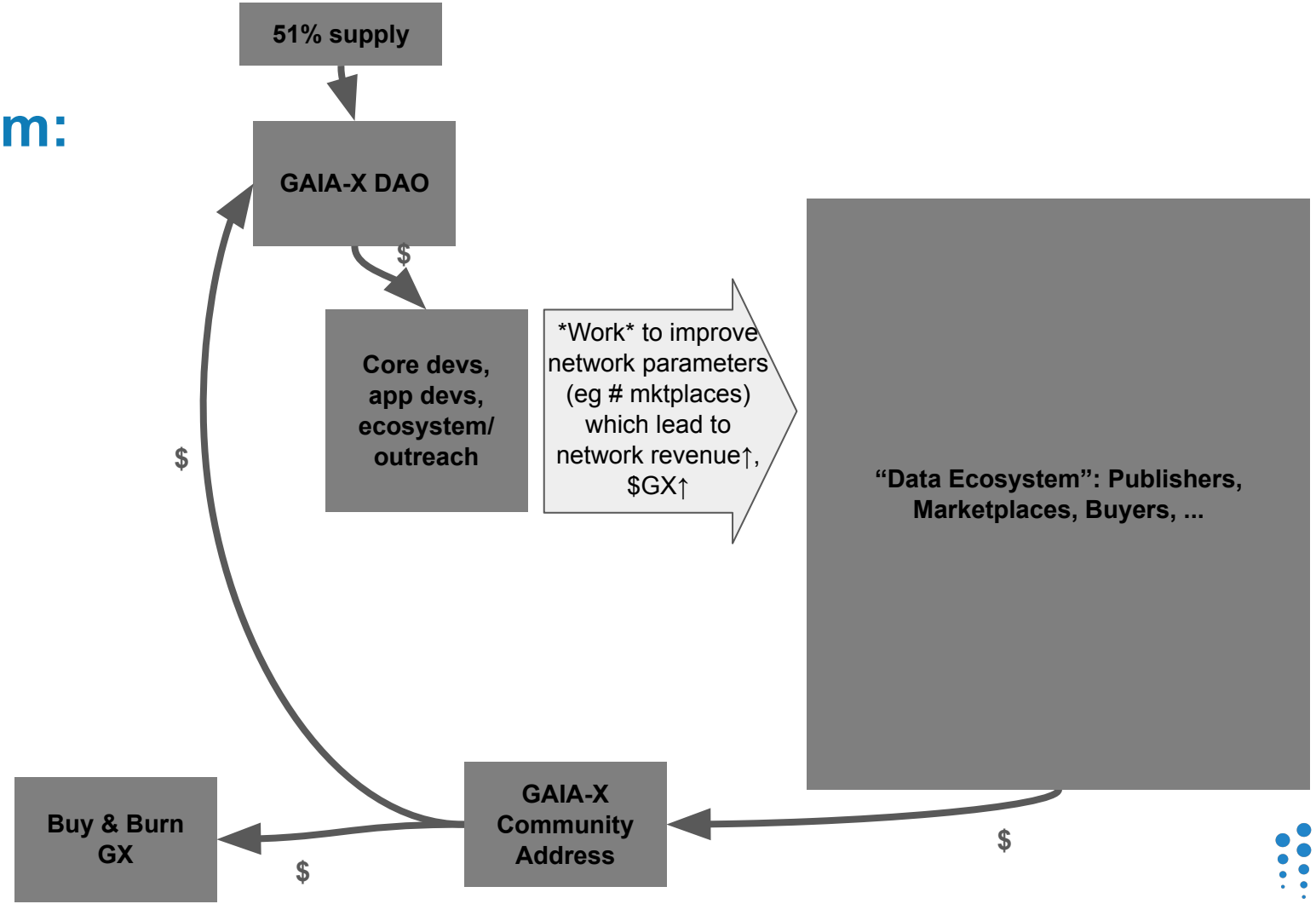
Agent-Based Simulation to Verify GAIA-X Ecosystem Sustainability

GAIA-X Ecosystem block diagram - simplified version



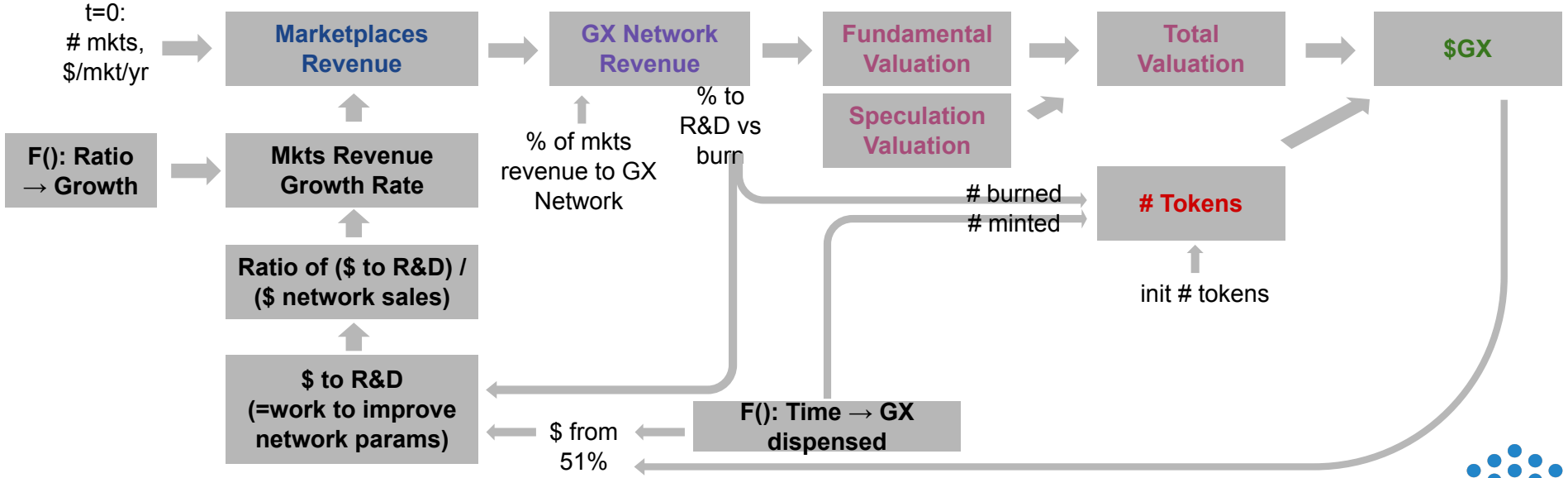
Details: Web3 Sustainability Loop

Block diagram: actual



Key variables being modeled

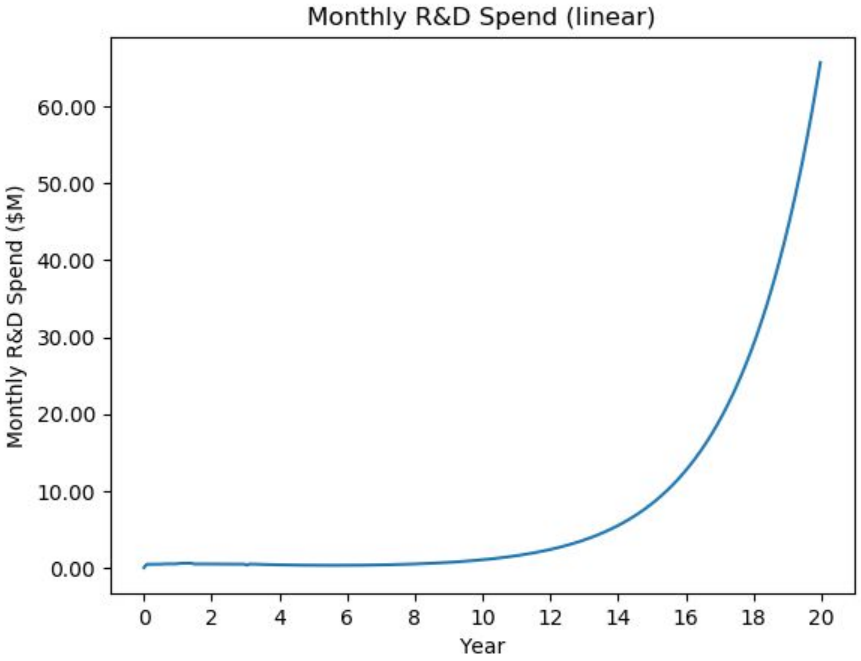
- We can model GAIA-X revenue and $GX over time. This helps our decision-making.
  - We can model **marketplaces' revenue**. Depends on initial parameters, and $ growth rates.
  - From that, we can model **GAIA-X network revenue**. Depends on % mkts revenue to GAIA-X network.
  - From that, we can model fundamental **valuation** of GAIA-X network (e.g. P/S). Can compare this to speculation-based component too.
  - We can also model **# tokens**, including effects of minting and burning
  - From valuation of GAIA-X network, and # tokens, we can model **$GX**

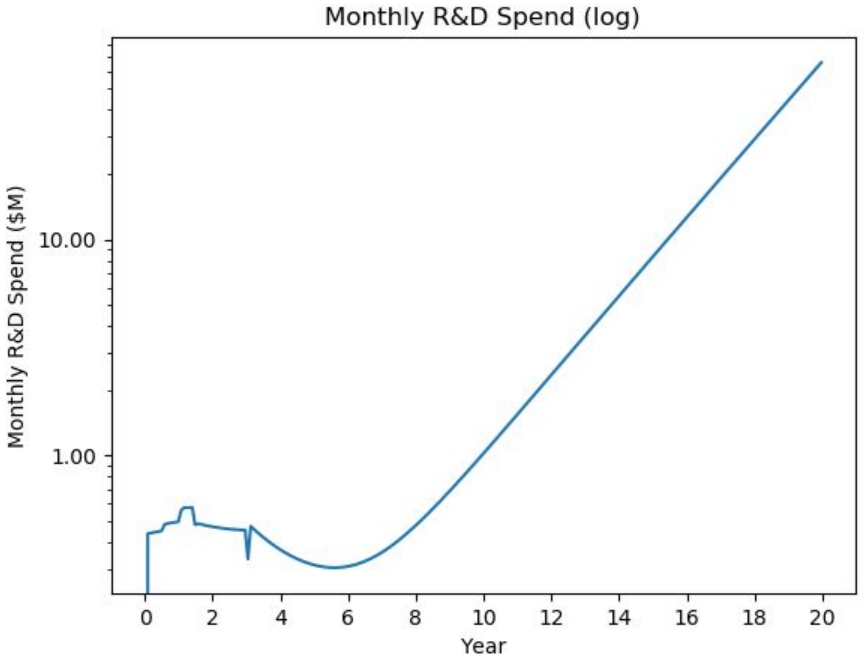


TokenSPICE Parameter Settings

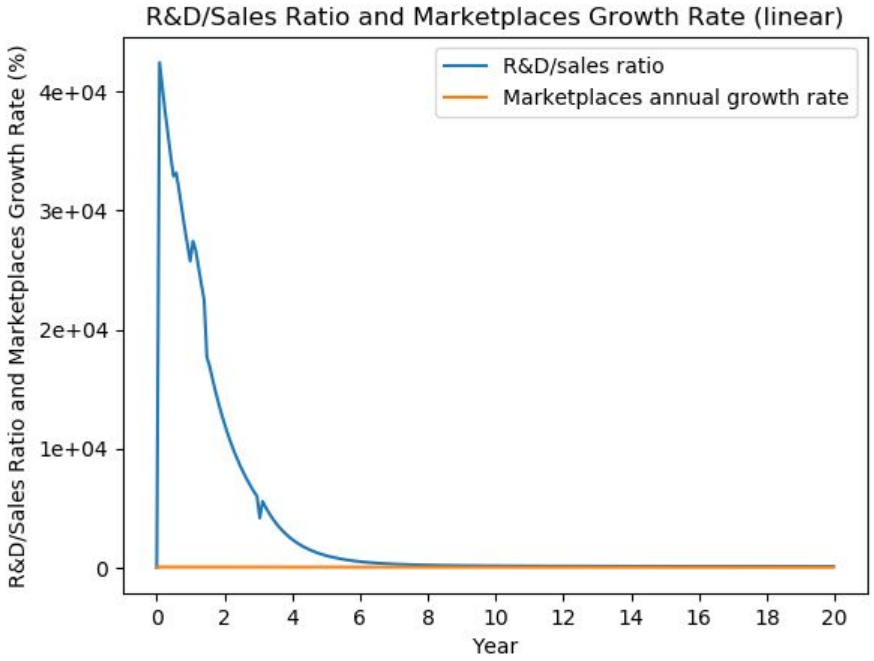
- Simulation time 20 years
- Growth rate info:
  - growth_rate_if_0_sales = -11.8% (for total = -25%)
  - max_growth_rate = 41.5% (for total = 100%)
  - tau = 0.6 (ie ratio needs to be 0.6 just for half the total range. MUCH higher than before)
  - $ R&D = grantTakersMonthlyRevenueNow(); $ sales = gaiaXMonthlyRevenueNow()
- GAIA-X toll from marketplaces revenue: 5%
- Speculation valuation at t=0: $20M
- Growth rate of speculation valuation: 10% / year
- Fundamentals valuation approach: P/S = 30x
- % of revenue to burn directly: 10%
- Ramped exponential minting: like right side of 20200505: H=4.0, T0=0.5, T1=1.0, T2=1.4, T3=3.0, M1=0.10, M2=0.25, M3=0.50. Stop after 34 halvings (about 125 years)
- DAO is funded by: minting over time, some pre-mine

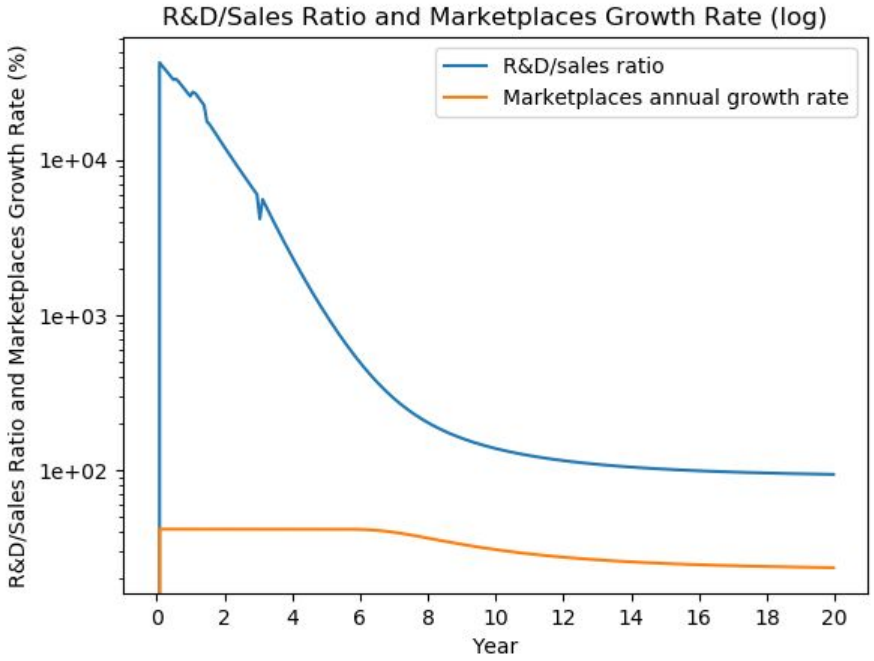
Monthly R&D Spend



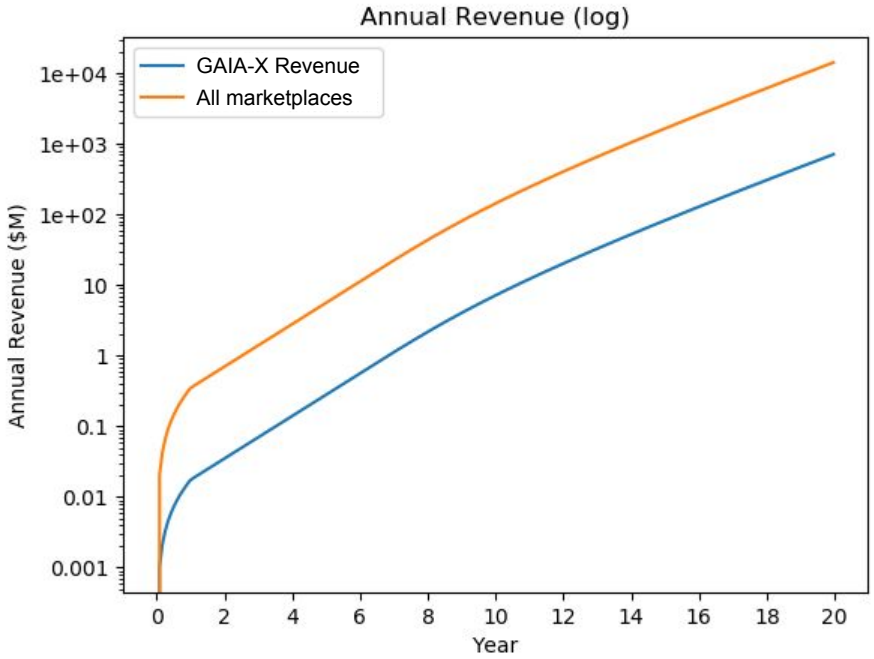


R&D/Sales Ratio, Marketplaces Growth Rate

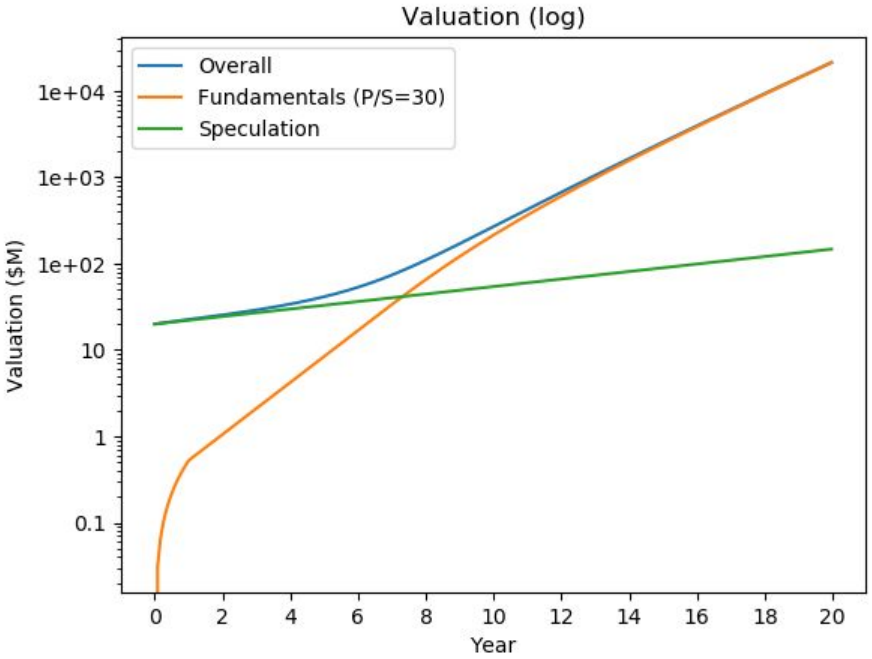




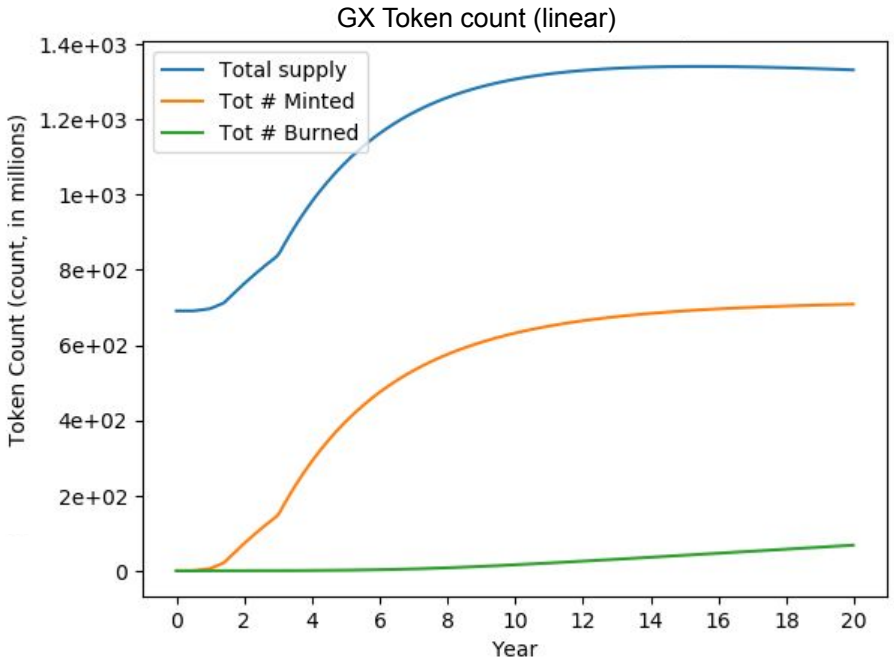
Revenue

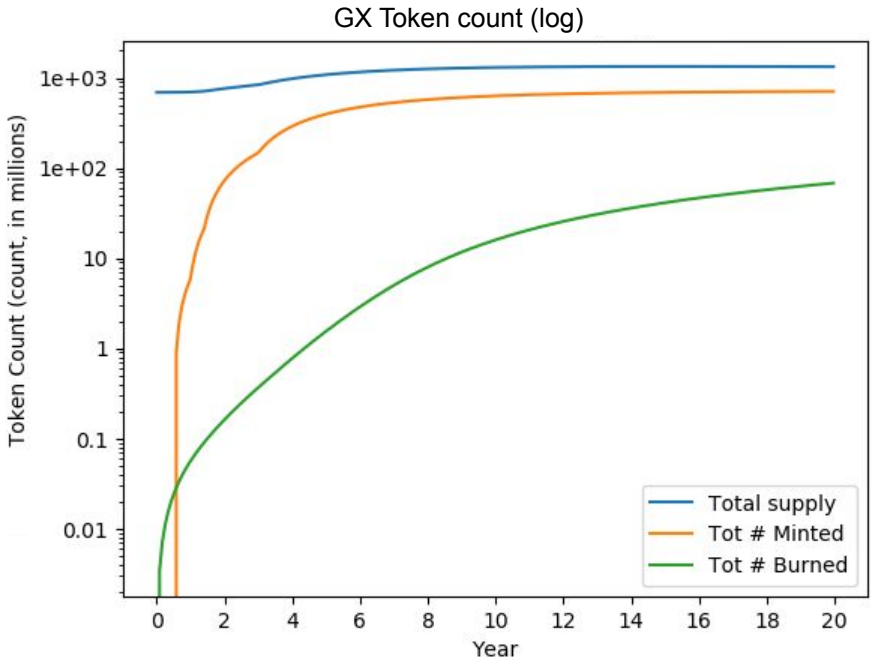

Annual Revenue (log)
GAIA-X Revenue
All marketplaces
Annual Revenue ($M)
1e+04
1e+03
1e+02
10
1
0.1
0.01
0.001
0
2
4
6
8
10
12
14
16
18
20
Year

Valuation


Valuation (log)
Overall
Fundamentals (P/S=30)
Speculation
1e+04
1e+03
1e+02
10
1
0.1
Valuation ($M)
0
2
4
6
8
10
12
14
16
18
20
Year

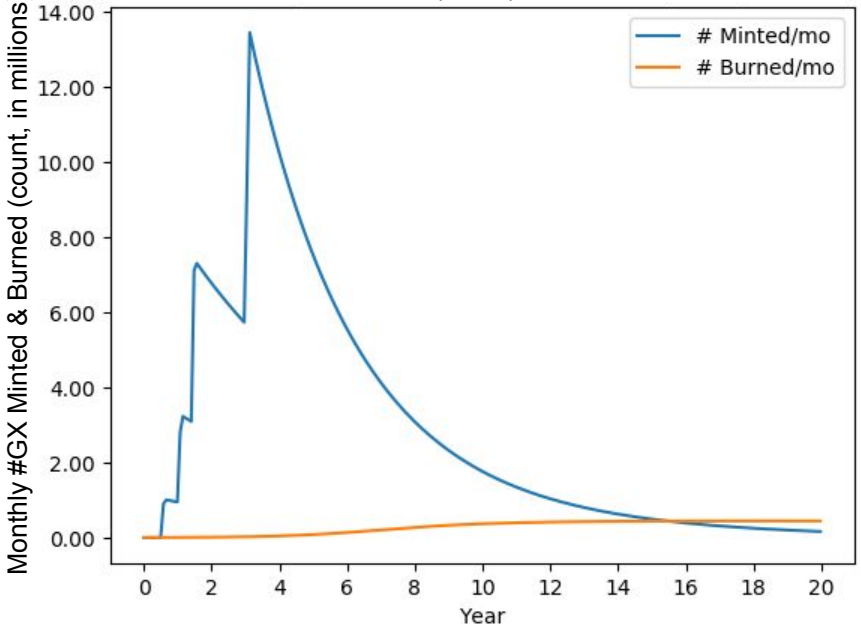
Token count


GX Token count (linear)
Total supply
Tot # Minted
Tot # Burned
Token Count (count, in millions)
1.4e+03
1.2e+03
1e+03
8e+02
6e+02
4e+02
2e+02
0
0
2
4
6
8
10
12
14
16
18
20
Year

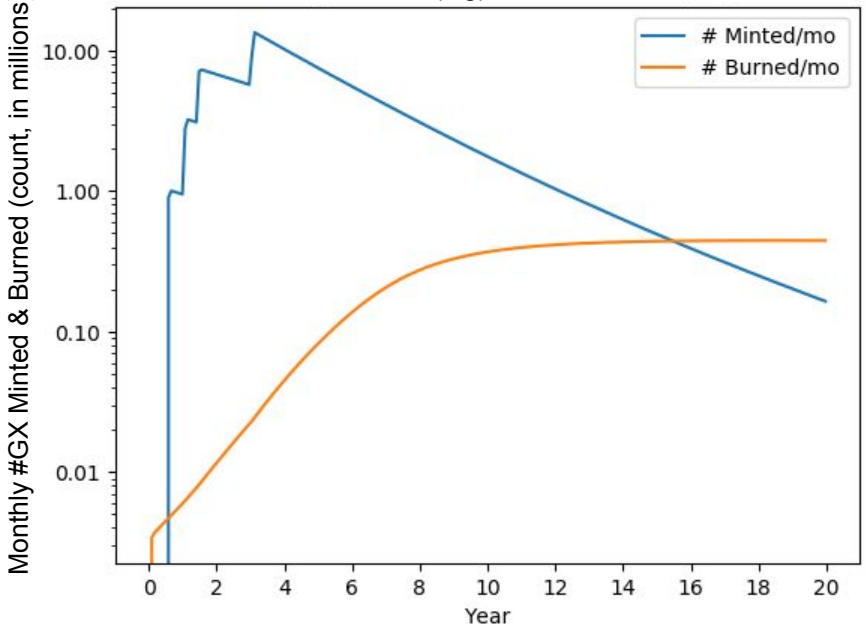

GX Token count (log)
Token Count (count, in millions)
1e+03
1e+02
10
1
0.1
0.01
0
2
4
6
8
10
12
14
16
18
20
Year
Total supply
Tot # Minted
Tot # Burned

Monthly # GX minted & burned

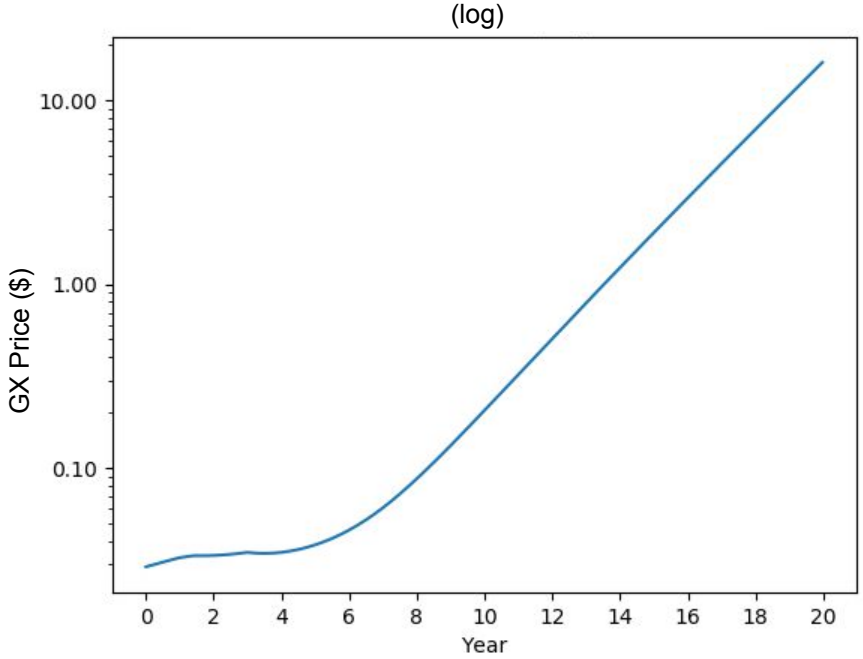
(linear)



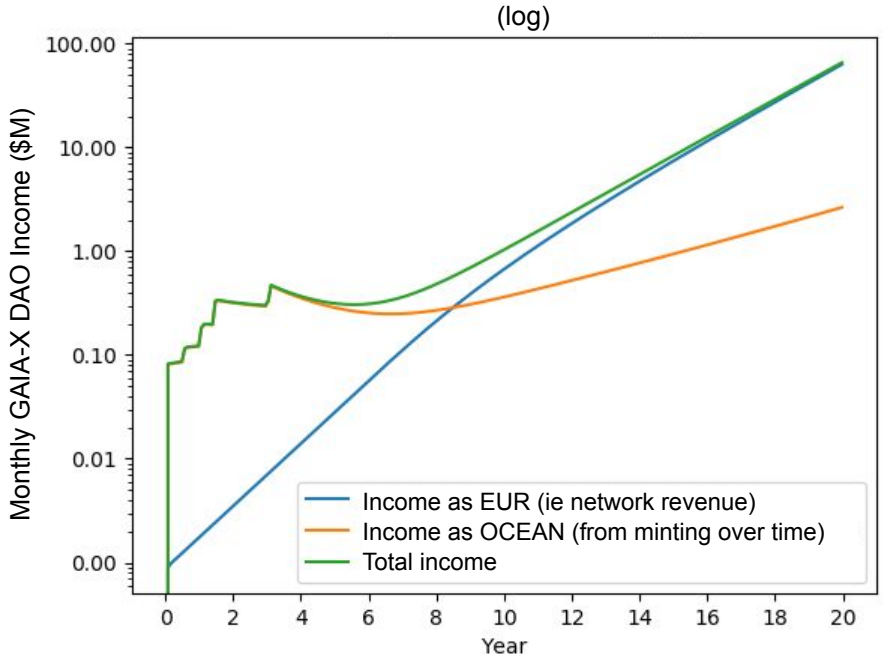
(log)



GX price = valuation / (num tokens)



GAIA-X DAO Income



Revisiting System-Level Goals

On GAIA-X Sustainability Goals

Summary: The “GAIA-X Sustainability Loop” meets the goals.

- ✓ GAIA-X ecosystem *sustainable and growing*, towards *ubiquity*
- ✓ Funding goes to teams writing code, doing outreach, over the long term (10+ years)
- ✓ GAIA-X funding 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

Now, given that a choice of system-level design will lead to goals of sub-blocks in the system.

Let’s zoom into sub-blocks.

We have a system-level design. What about the sub-blocks?

GAIA-X Sub-block goals & how

A choice of system-level design leads to specific goals for sub-blocks, as follows:

- Data Ecosystem: Blockchain, smart contracts, and backend services
  - **Goal: meet GAIA-X specs for data sharing. (Many specs!!)**
  - How: pragmatic design & open-source implementation of smart contracts, backend services, libraries
  - **Goal: as tx volume goes up, it drives $GX**
  - How: 10% of network tx fees go to GAIA-X community. A fraction of that is burned.

- Data Ecosystem: Marketplace apps:
  - **Goal: Get “work” and skin-in-the-game by curators, referrers, third-party marketplace owners**
  - How: pragmatic design & open-source implementation of marketplace app

- GAIA-X DAO:
  - **Goal: curation of projects (governance) encourages skin-in-the-game and long-term sustainability**
  - How: DAO where anyone can propose projects, GX token to vote. Funded by GX token minting & network revenues.

Sub-Block: GAIA-X DAO

GAIA-X and DAOs

4.1 Decentralized Autonomous Organization

Decentralized Autonomous Organization[1], DAO, is a type of governing model where:

- There is no central leadership.
- Decisions are made by the community's members.
- The regulation is done by a set of automatically enforceable rules on a distributed ledger whose goal is to incentive its community's members to achieve a shared common mission.
- The organization has its own rules, including for managing its own funds.

4.2 Gaia-X Association roles

👀 Based on the objective and constraints to achieve those objectives, Gaia-X Association is creating a Gaia-X DAO.

https://www.gaia-x.eu/sites/default/files/2021-06/Gaia-X_Architecture_Document_2106.pdf

How might GAIA-X DAO look?

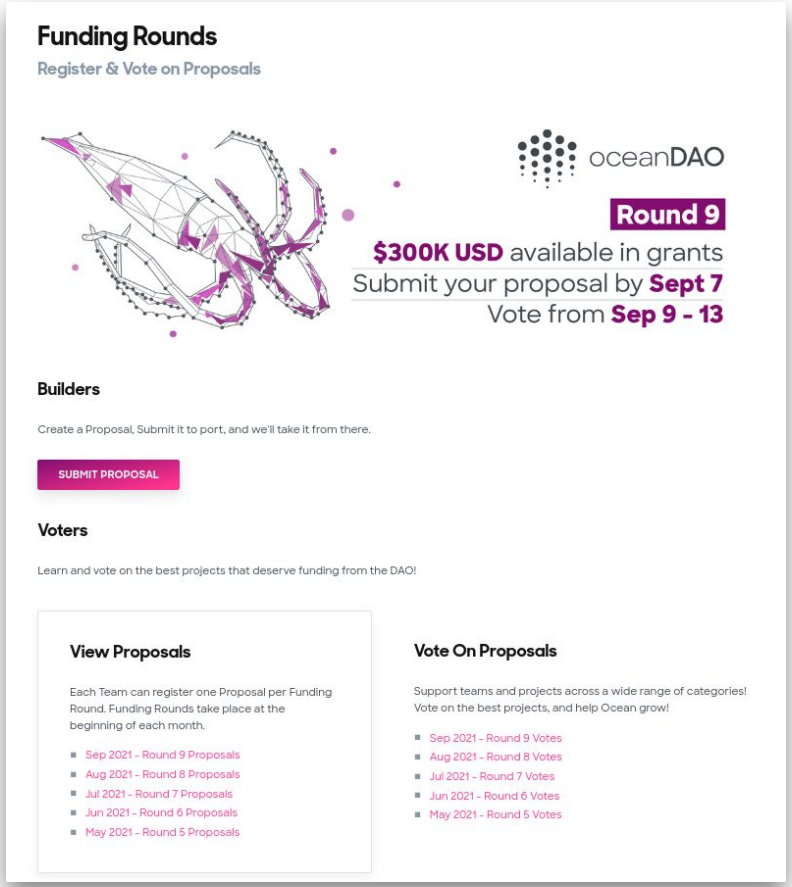
GAIA-X DAO is a grants DAO to help fund GAIA-X community projects, curated by the GAIA-X community.

- Anyone can propose a project
- There is open discussion in forums and town halls
- Vote on proposals with GX token
- $100K to $1M+ per month funding available (see simulations)

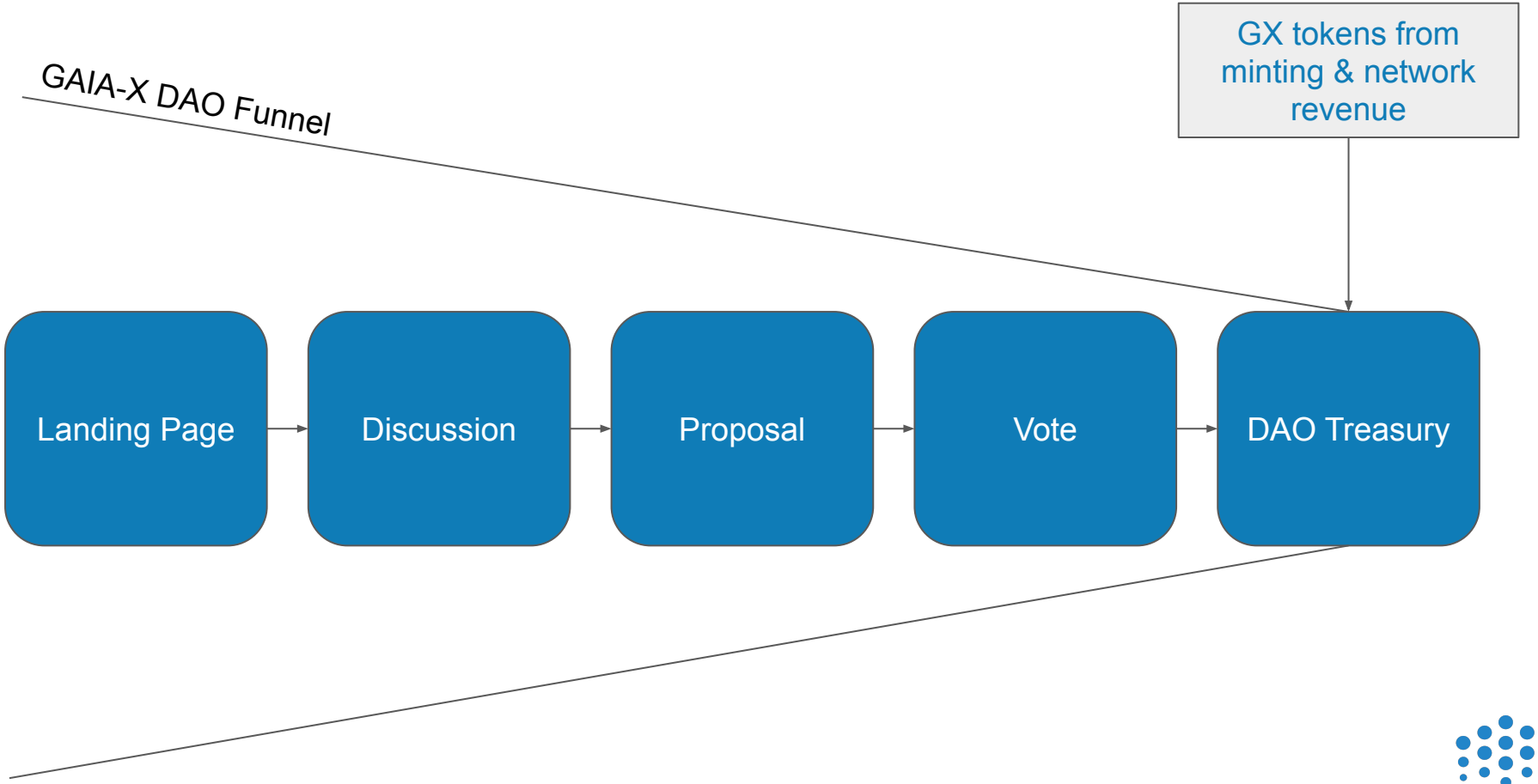
- Key constraint: expected ROI > 1.0 of grants over time

(Inspiration from OceanDAO https://blog.oceanprotocol.com/introducing-oceandao-efe9ed681b84 **)**

Example landing page - OceanDAO



GAIA-X DAO Component Stack



A monthly cadence of funding cycles

Proposals Close & Voting Opens	Voting Closes	Funds Sent	Next Round Proposals Open
1st Day	4th Day	5th day	6th day

*Days ending at midnight GMT

+

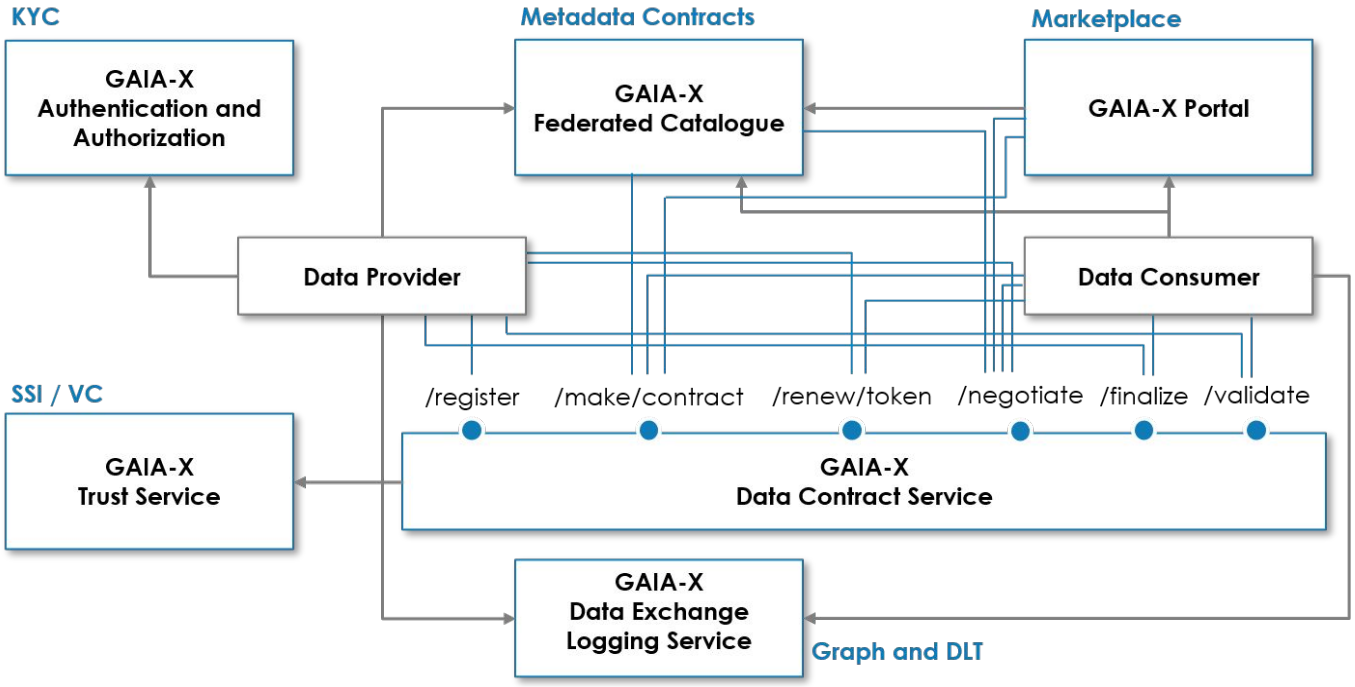
Town Hall

Wednesdays

Sub-Block:
Data Ecosystem

Q: How to implement a data ecosystem reconciling GAIA-X Sustainability Loop?
A: Support GX token at data ecosystem level, via DLT

Example: GAIA-X Reference Architecture with DLT components (ref. Ocean Protocol)



Source: Sovereign Data Exchange Data Contract Service
https://www.gxfs.de/federation-services/overview-specification-documents/

deltaDAO

Access Control

Tokenized data access control on DLT

Access to data services managed by smart contracts

If a consumer spends a datatoken, access is granted. More conditions in the SC are possible.

Access control

Token-based data access control on DLT.

Data access rights in the form of datatokens can be transferred on-chain. Smart Contracts become a tool to pool data and conditionalize data sharing.

deltaDAO

Data Traceability and Integrity

Each access to data services is recorded on-chain

Results of computations can be registered on chain as well

Subsequent data uses can be tracked and traced

Ensure Data Traceability and Integrity

AI model and Data Lineage Tracking. Traceability by design. Enabled by Smart Contracts.

Smart Contracts enable trustless traceability and auditability of data services, also for subsequent data use.

deltaDAO

Data Portals

Buy & sell data services on data portals, enabled by Smart Contracts

Download, stream, or access data via compute-to-data enabled by Smart Contracts

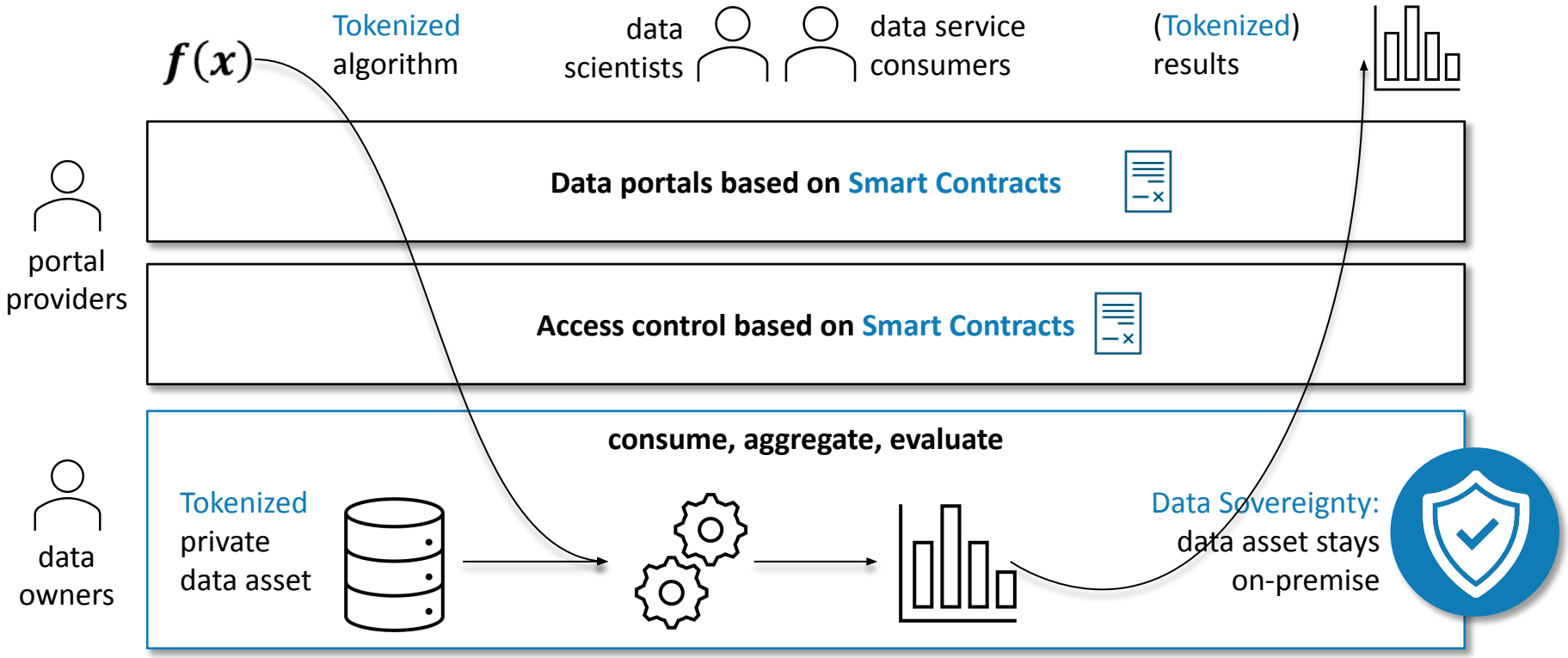
Smart Contracts enable on-chain datamarkets with integrated price discovery.

Simplify Data Exchange and Monetization

Easy to share, consume, sell and buy.

deltaDAO

Layered design for privacy-preserving data sharing

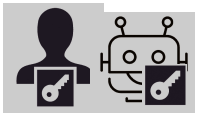


GAIA-X Stakeholders per layer

U
Users


data owners


data scientists


consumers


portal providers


analysts


governance

L3
Applications

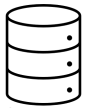

portals

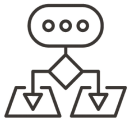

applications


AI

L2
Infra-structure


(private) data assets


metadata caches


(private) algorithms


access controller


(private) CtD cluster

L1
DLT


validator nodes


metadata smart contracts


data access & exchange contracts


access records & audit trail

deltaDAO

Benefits of DLT-based implementations of GAIA-X

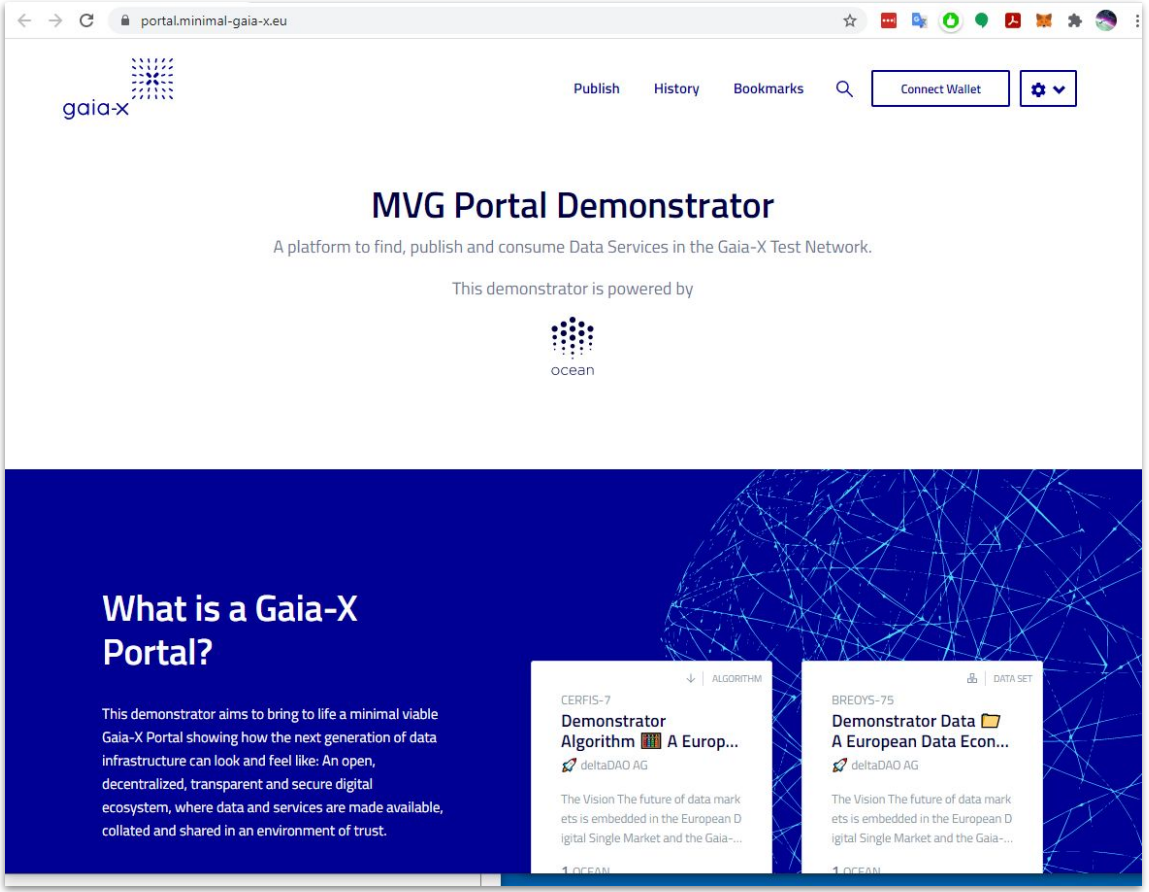
Ecosystem sustainability (our focus here)	Sustainable business models and aligned incentives for all participants	GDPR-compliance by design
Data monetization with automatic price discovery	Data owners always keep full control	Accessability and Availability
Auditability, Provenance and transparency by design	Scaling: cross-listing of datasets across all datamarkets	No vendor lock-in

deltaDAO

Sub-Sub-Block:
GAIA-X Portal

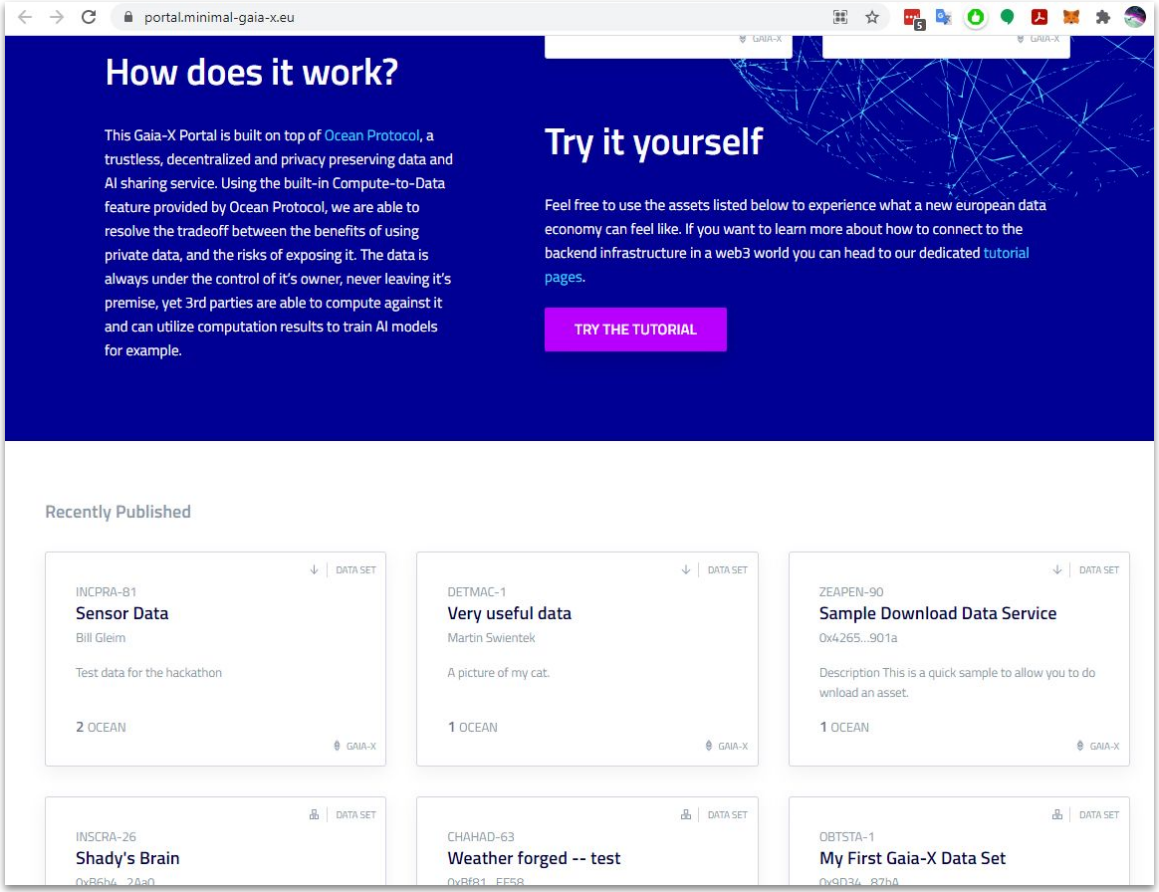
MVG Portal Demo - Splash Screen

https://portal.minimal-gaia-x.eu/



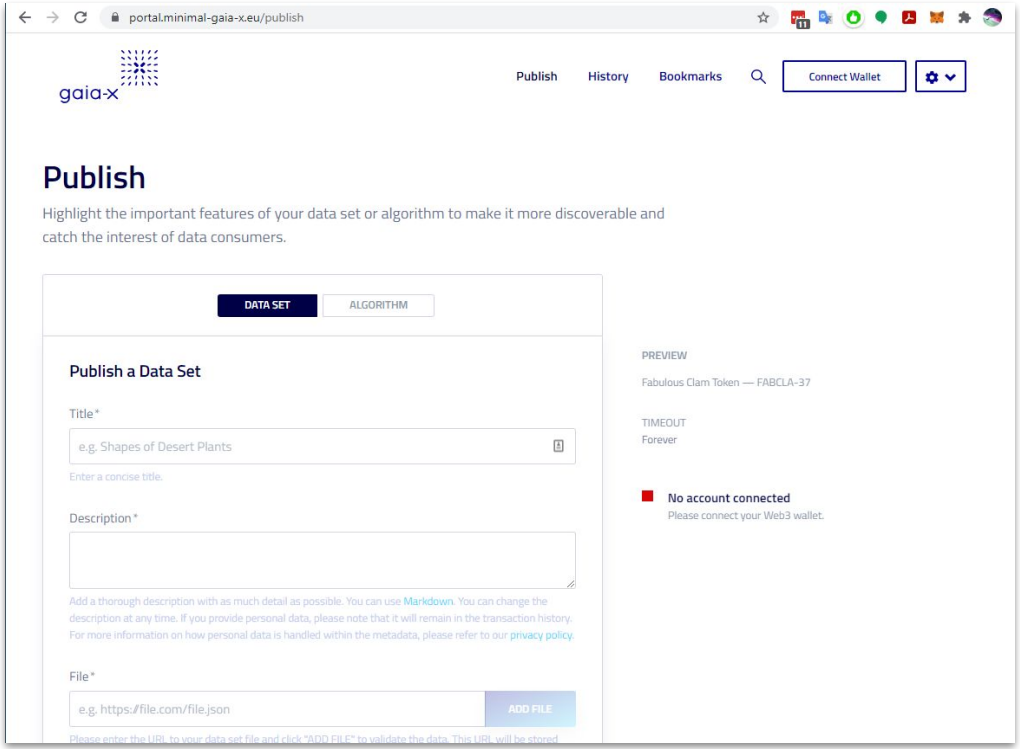
MVG Portal - Browse Assets

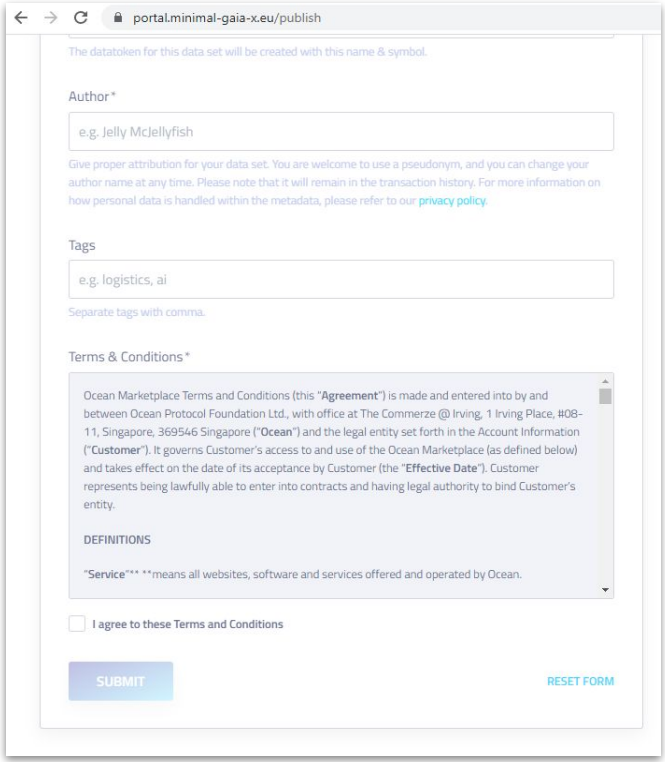
https://portal.minimal-gaia-x.eu/



MVG Portal - Publish Flow

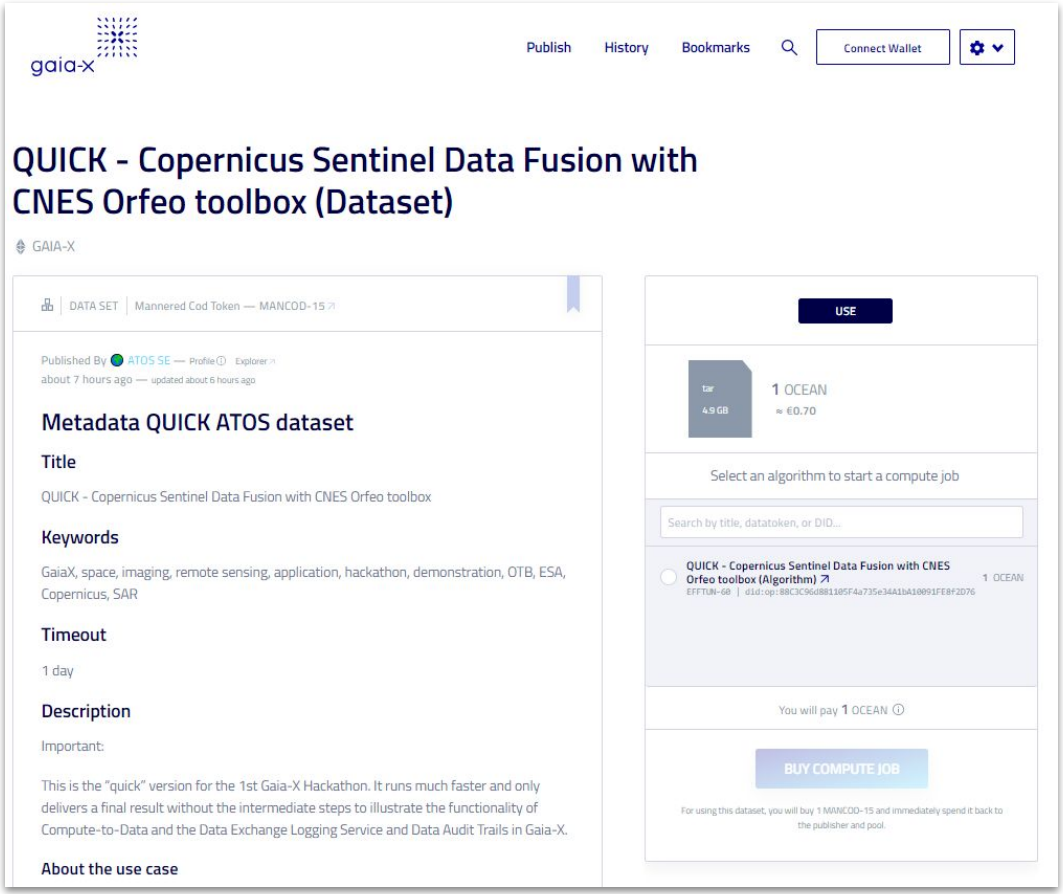
https://portal.minimal-gaia-x.eu/publish





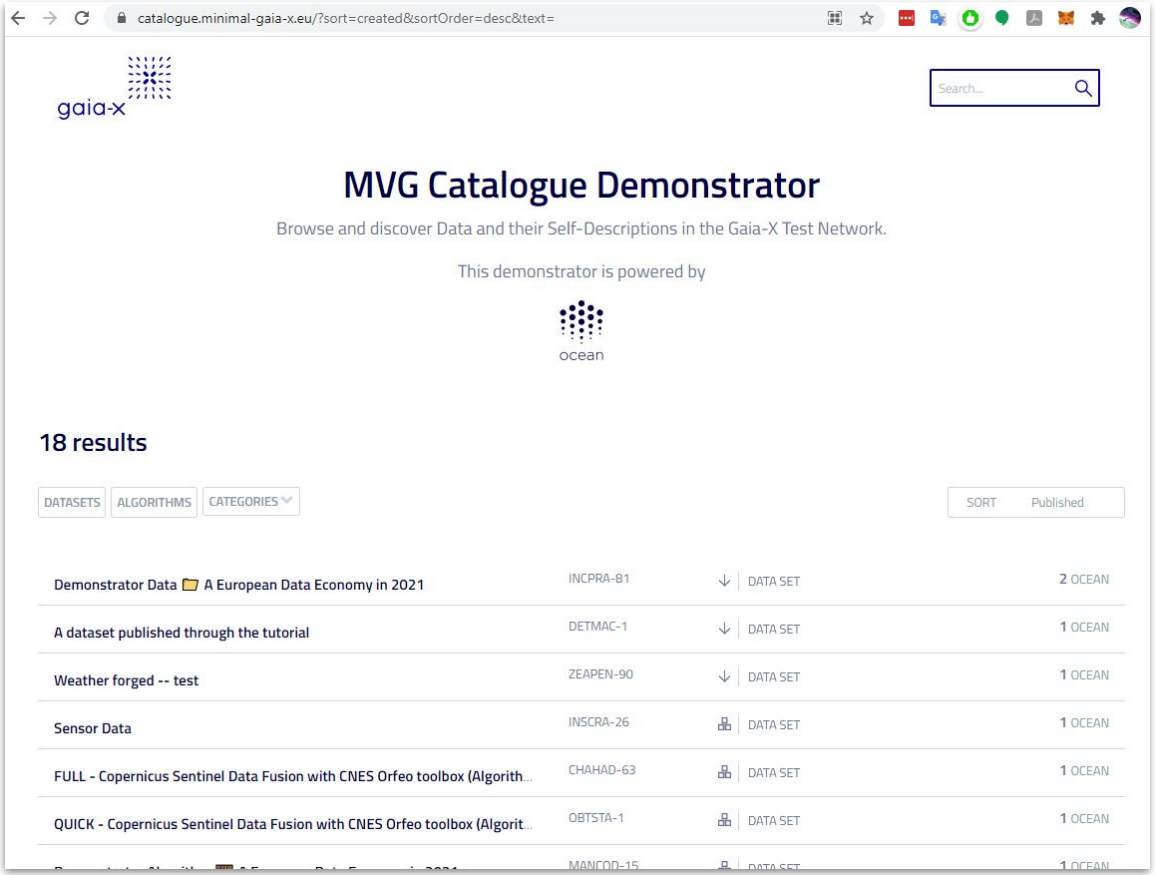
Example Data Asset: Fixed Pricing (ATOS data)

https://portal.minimal-gaia-x.eu/asset/did:op:Dfa927A926481ce8Da68A9909785AD8d829804F2



MVG Catalogue Demonstrator

https://catalogue.minimal-gaia-x.eu/



Conclusion

Conclusion

- Introduced an approach for GAIA-X sustainability
  - Drawing on a $GX token
  - System-level design: Web3 Sustainability Loop
  - Sub-block: GAIA-X DAO for grants
  - Sub-block: Data ecosystem
- Verified with agent-based simulation (TokenSPICE)
- Provided an example DLT-based implementation (Ocean)