



Sustainable Infrastructure for
AI-Empowered Open & Collaborative
Decentralized Science

Ecosystem Blueprint Ver. 1

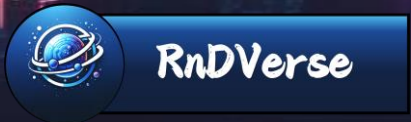
Built by: Dominikus Brian

Presented for



2024/05/17

A Platform By:



梦溪数智

DreamBrook Tech



Sustainable Infrastructure for AI-Empowered Open & Collaborative Decentralized Science

Problem we are solving

Cloud collaboration and Science Crowdsourcing are critical for Decentralized Science. Unfortunately, today the infrastructure for these activities are still marginal and mostly controlled by centralized big-tech entity, high-cost paywalled system, and often provided exclusively only for specific groups of people.

We believe decentralized science should and can benefit more with open-sourced infrastructure developed natively on Decentralized Supercloud like Akash.

Target User Groups

Scientist, Engineers, Researchers, Teacher, Graduate Students, Science Enthusiast, ResearchPreneurs, and more...

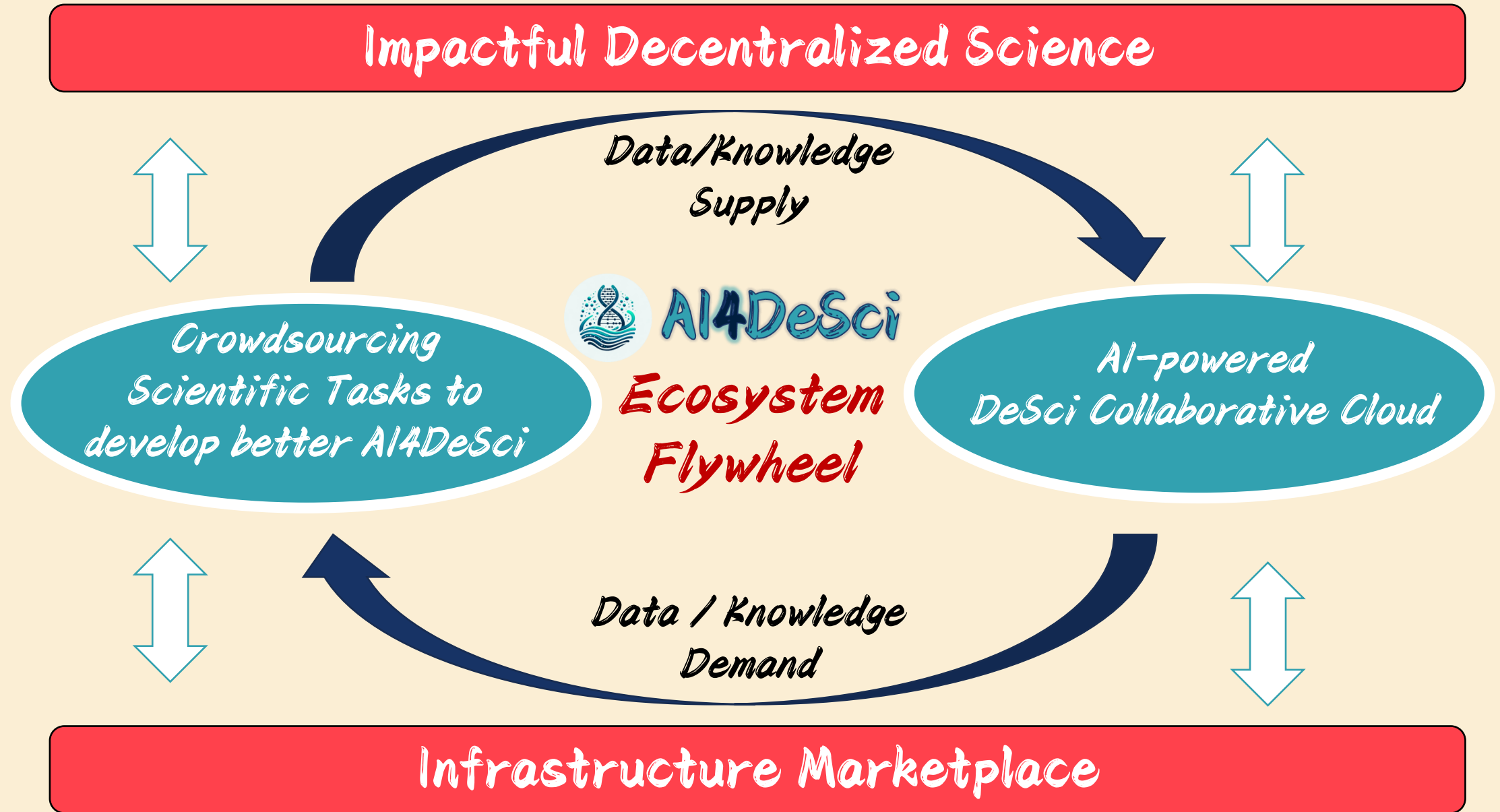
Akashathon² AI Track Objective / Requirements

- Exploration of AI Integration
- Optimization for Decentralized Environment
- Cost-Effectiveness
- Scalability and Flexibility
- Open Source Licensing and Documentation

How we answers to this challenges via AI4DeSci

AI4DeSci integrate AI as native core components across our infrastructure for facilitating DeSci Cloud Collaboration and Science Crowdsourcing. By having this AI-Infrastructure build exclusively on-top of scalable decentralized cloud ecosystem like Akash.network, the cost for operation and especially for public access to state-of-the-art digital technologies are becoming very cost-effective. Moreover, the flywheel of internal economy on the ecosystem will also ensure long-term sustainability. The AI4DeSci project is envisioned to be an always open-source with MIT License, allowing all community members to bring the best out of it.

Our Proposed Solution





Decentralized Science (DeSci) with Real World Impact
Fast & Flexible | Cost Effective | Open & Collaborative | Bias Tolerant

DeSci Collaborative Cloud

Facilitating [Human-Human, Human-AI, AI-AI] Collaboration by lowering tech-adoption barrier and democratizing access to latest scientific tools/software on the cloud

AI-Powered Science Crowdsourcing

Co-Creation of Knowledge to Developed Better AI, and Utilizing AI for Better Knowledge Creation.

Scientific Mini-Apps

AI4DeSci

Sustainable Infrastructure for
AI-Empowered Open & Collaborative DeSci

Science Crowdsourcing Toolkit

Cloud Deployments
100%  **akash**

Cross Blockchains Support

Decentralized
AI x Blockchain x Cloud x Data
Infrastructure

Open-Sourced
AI & LLMs
Data Solution:
e.g. Storj/Jackal/Flyte/...

Traditional Centralized Research Collaboration Stack

University | Research Institute | Government Labs

Slow & Bureaucratic | Overbudget | Exclusive | Heavily Opiniated

Collaborative Cloud

Google Colab + Overleaf

Science Crowdsourcing

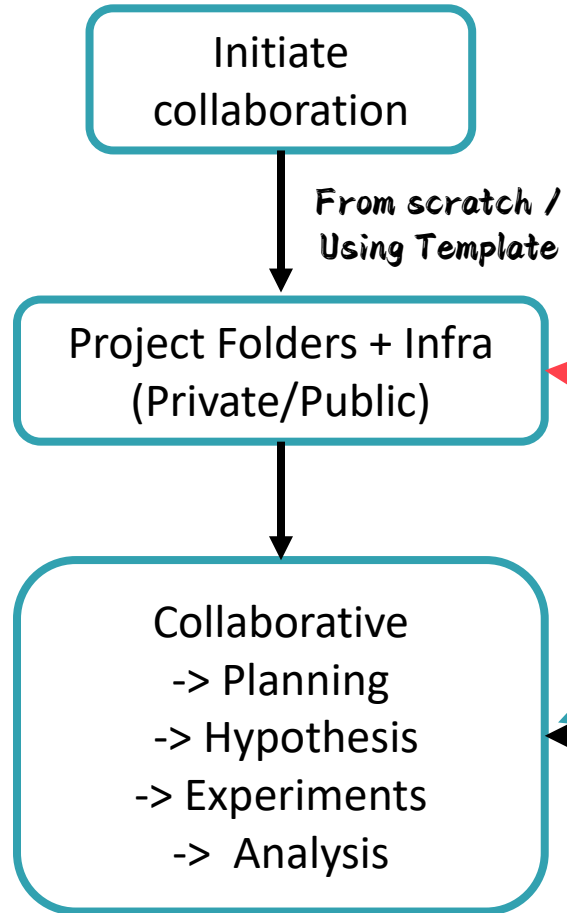
Self-developed, Self-hosted, Self-Maintained
Folding@Home, GalaxyZoo, Picbreeder...

Closed Research Team
On minimum Payroll/Budget

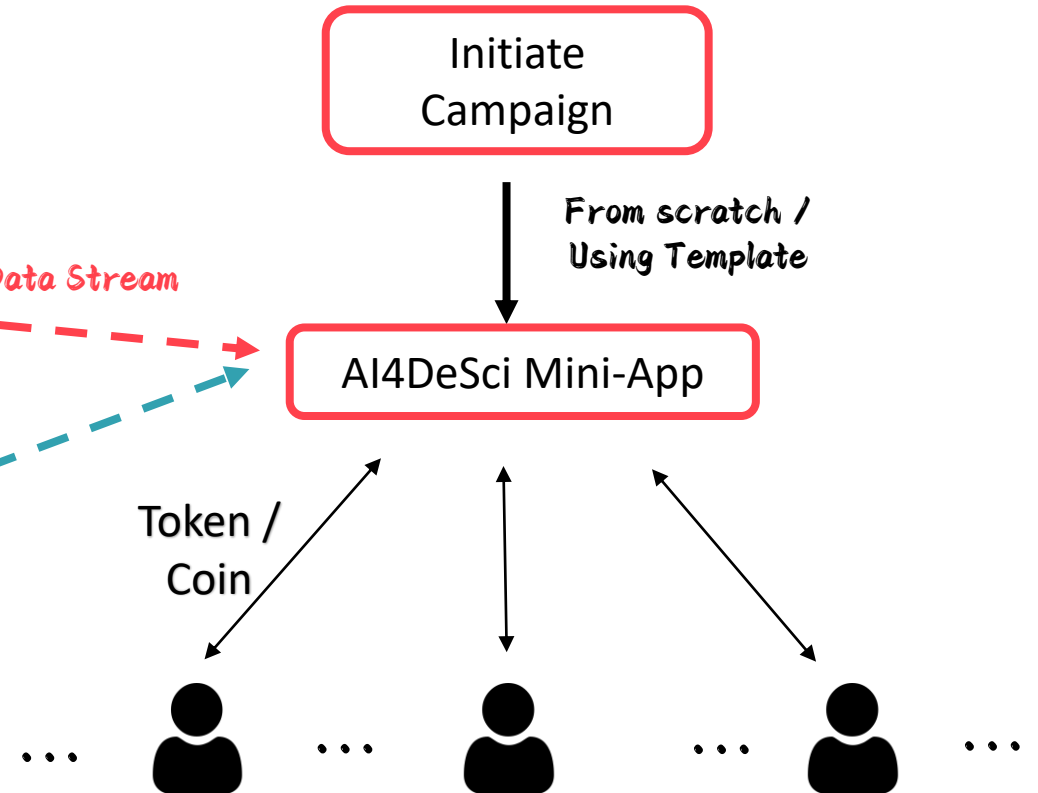
Google AWS Azure | Government Supercomputers |
University HPC & Data Center

Main Workflow for Core Platforms

DeSci Collaborative Cloud



AI-Powered Science Crowdsourcing



Data Stream

Workplan Update

3 Collaboration forms:

Human-AI Agents, AI Agents - AI Agents, Human - Human

3 Types of Work :

Generate Data, Validate Data, Explore Data

Forms of Collaboration

Human - AI Agent(s)

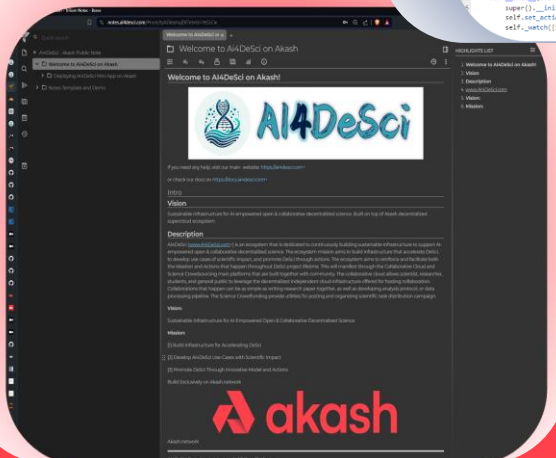
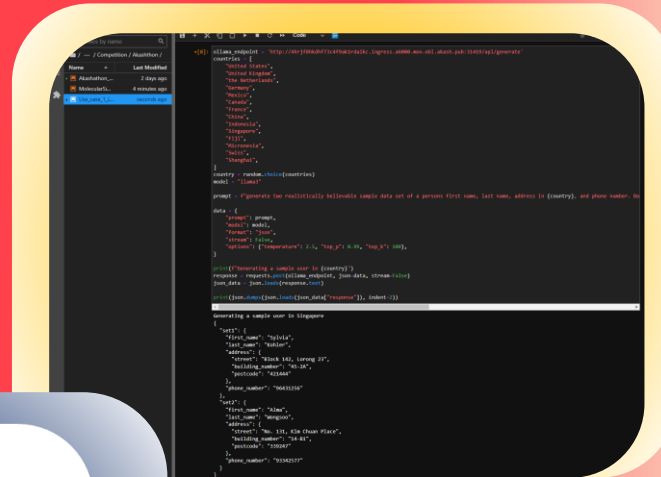
Ollama server & vllm as endpoints,
Interact via colab.ai4desci.com
spawned notebook

AI Agent(s) - AI Agent(s)

Various templates and ready-to-
call AI-Agents living across
distributed LLM inference point
interacting @ colab.ai4desci.com

Human-Human

Cheap and out-of-the-box
collaboration note self-hosting for
each collaboration project
through notes.ai4desci.com



Types of Work

Gather Data

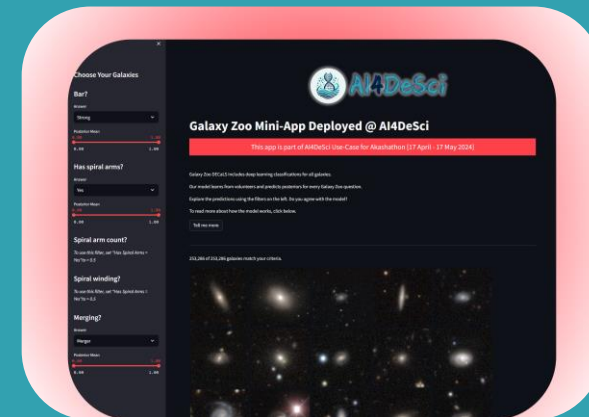
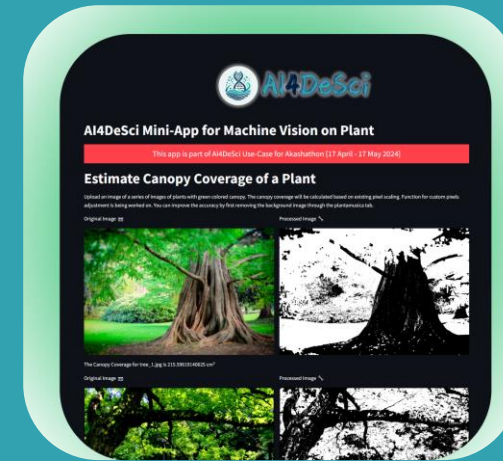
Other Scientist/ Researchers
/Students, and General Public
can help research project
gather more data or
rigorously labels existing data

Validate Data

The community can be
rewarded for double-check, or
performing data provenance
and reproducibility. Ensuring
High-quality scientific data

Explore Data

The wisdom of crowd can never
be underestimated. Provided
the tools fascinating discovery
can happen.



Proof-of-Concept and MVP built for and during the Akashathon² 2024

*SDL Gallery for all
Deployments Shared @ GitHub
[https://github.com/RnDVerse/
AI4DeSci](https://github.com/RnDVerse/AI4DeSci)*

*AI4DeSci Official Docs,
Whitepaper, and Pitch Deck
docs.ai4desci.cloud*

*DeSci Collaborative Cloud
Note Collabs
notes.ai4desci.com*

*Landing Page and
Ecosystem Main
Navigation Entrypoint :
www.ai4desci.com*

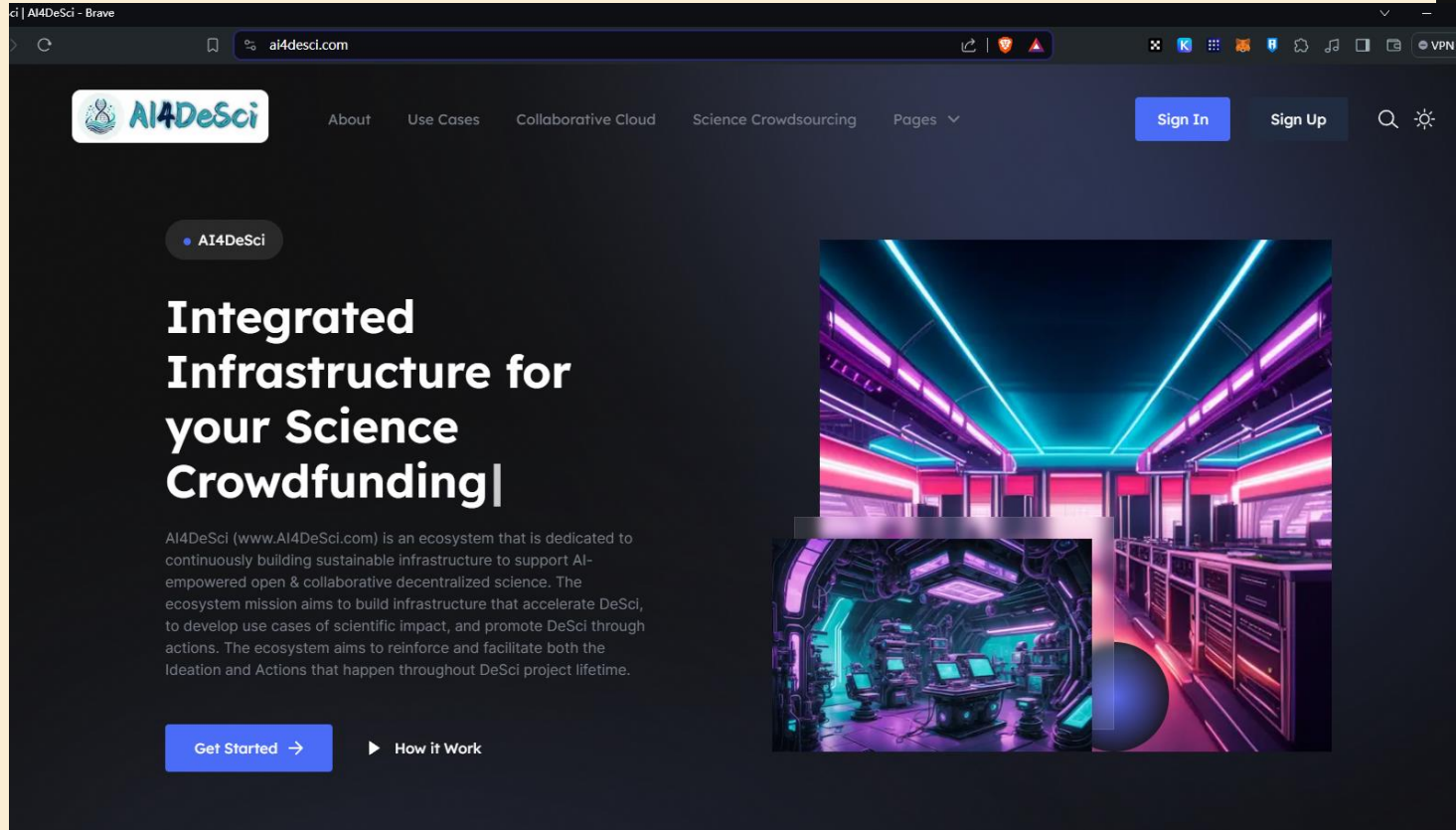
*Science Crowdfunding
App Gallery and Use
Cases
app.ai4desci.com,
miniappl.ai4desci.com –
miniapp8.ai4desci.com*

*DeSci Collaborative Cloud
Main Hub
hub.ai4desci.com*

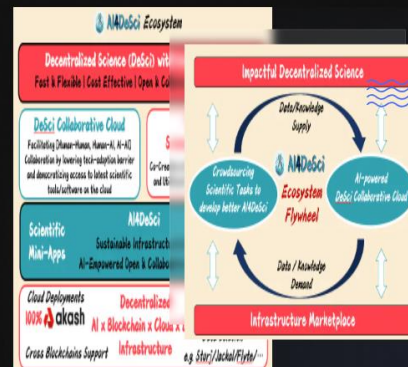
*DeSci Collaborative Cloud
workspace
colab.ai4desci.com*

*AI4DeSci cloud infrastructure
overview dashboard
ai4desci.cloud*

*AI4DeSci Provider Server @ Akash
provider.ai4desci.network:8443*



AI4DeSci (www.AI4DeSci.com) is an ecosystem that is dedicated to continuously building sustainable infrastructure to support AI-empowered open & collaborative decentralized science. The ecosystem mission aims to build infrastructure that accelerate DeSci, to develop use cases of scientific impact, and promote DeSci through actions. The ecosystem aims to reinforce and facilitate both the Ideation and Actions that happen throughout DeSci project lifetime.



DeSci Collaborative Cloud, AI-Empowered Science Crowdfunding

AI4DeSci (www.AI4DeSci.com) is an ecosystem that is dedicated to continuously building sustainable infrastructure to support AI-empowered open & collaborative decentralized science.

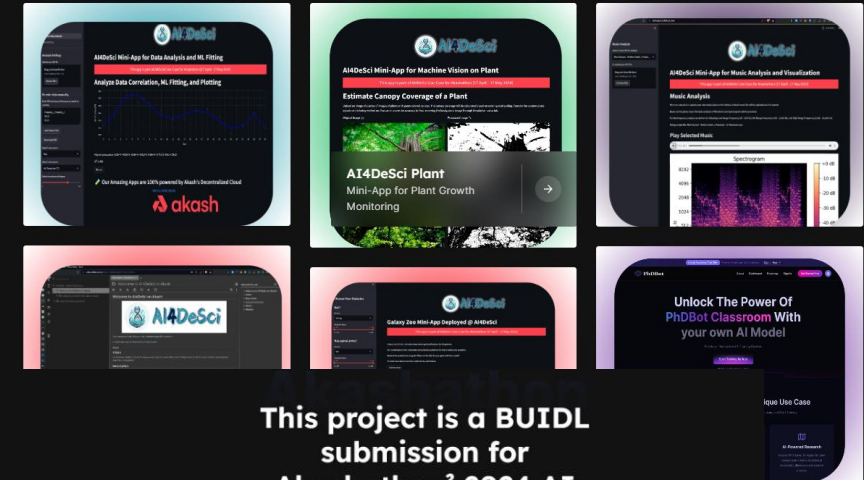
The ecosystem mission aims to build infrastructure that accelerate DeSci, to develop use cases of scientific impact, and promote DeSci through actions.

The ecosystem aims to reinforce and facilitate both the Ideation and Actions that happen throughout DeSci project lifetime. This will manifest through the Collaborative Cloud and Science Crowdsourcing main platforms that are built together with community.

DeSci Collaborative Cloud & Science Crowdsourcing

We focus on two use cases: DeSci Collaborative Cloud that empower Idea Creations and Science Crowdsourcing that brings AI-Empowered Decentralized Science to be More Accessible to the Public.

All Science Crowdsourcing Collaborative Cloud



This project is a BUIDL submission for Akashathon² 2024 AI Track

This track challenges participants to explore the integration of artificial intelligence (AI) technologies within the Akash Network, specifically focusing on GPU usage. As AI applications become increasingly complex and resource-intensive, the need for scalable, open source and cost-effective infrastructure is paramount. Akash Network offers a unique solution by enabling developers to deploy and scale their AI workloads on a decentralized network of GPUs.

"Akashathon² participants will delve into the limitless possibilities of AI applications empowered by Akash's GPU marketplace. Whether you're passionate about revolutionizing crypto with AI or crafting tools to enhance the accessibility and usability of the Akash network for both providers and deployers, this hackathon is your platform to innovate!

Akash.Network
Akashathon 2024




AI4DeSci Dashboard

Collaboration Hub

Public Collaborative Journal Note
[pass: akashathon2024]

[Learn More About AI4DeSci]
[https://ai4deseci.com/]




AI4DeSci

AI4DeSci Science Crowdsourcing App Gallery

This app is part of AI4DeSci Use-Case for Akashathon [17 April - 17 May 2024]

In-House Science CrowdSourcing Apps




#1 : Machine Vision on Plant

AI Powered Plant Growth Monitoring. User need to upload plant images and identify properties to help model learn better.

Public Link - <https://mvsapp.ai4deseci.com/>

Raw Link - <https://github.com/akashathon2024/ai4deseci-mvsapp>




#2 : Data Analysis and ML Fitting

Explore data from a CSV by uploading the CSV and converting it into an interactive dataframe. Perform ML fitting to produce models.

Public Link - <https://mvsapp2.ai4deseci.com/>

Raw Link - <https://github.com/akashathon2024/ai4deseci-mvsapp2>






#3 : Music Analysis and Labelling

Analyse Music together with Human. Provide scientific insight to acoustic study.

Public Link - <https://mvsapp3.ai4deseci.com/>

Raw Link - <https://github.com/akashathon2024/ai4deseci-mvsapp3>

Upcoming Apps Under Development (see and test at your own risk)






AI4DeSci Dashboard

Science Crowdsourcing

Public Collaborative Journal Note
[pass: akashathon2024]

[Learn More About AI4DeSci]




AI4DeSci

AI4DeSci Cloud Collaboration Hub

This app is part of AI4DeSci Use-Case for Akashathon [17 April - 17 May 2024]

Human - AI Agents Cloud Collaboration

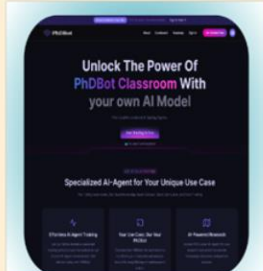


AI4DeSci Colab

AI Agents Powered Collaboration. JupyterHub Servers.

Public Link - <https://colab.ai4deseci.com/>

Raw Link - <https://github.com/akashathon2024/ai4deseci-colab>




PhD Bot Classroom

Train your own domain-specific PhD Bot.

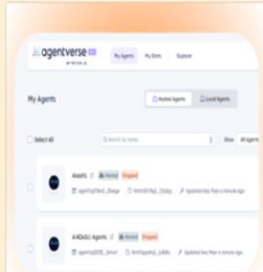
Public Link - <https://colabverse.ai4deseci.com/>

Raw Link - <https://github.com/akashathon2024/ai4deseci-colabverse>

AI Agents - AI Agents Cloud Collaboration



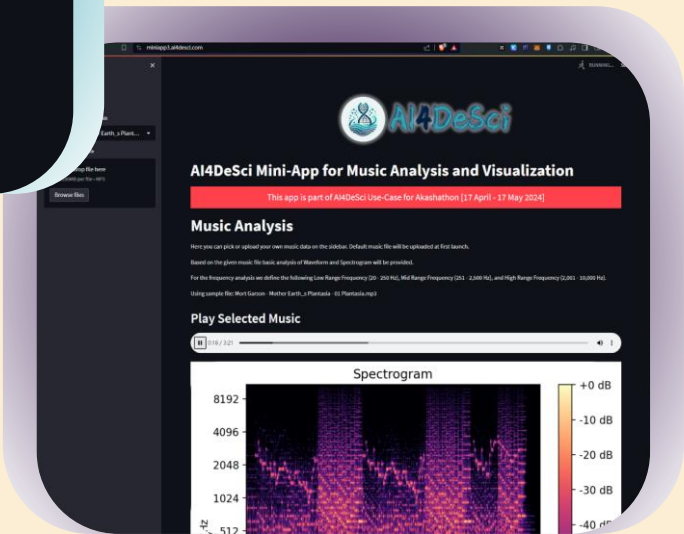
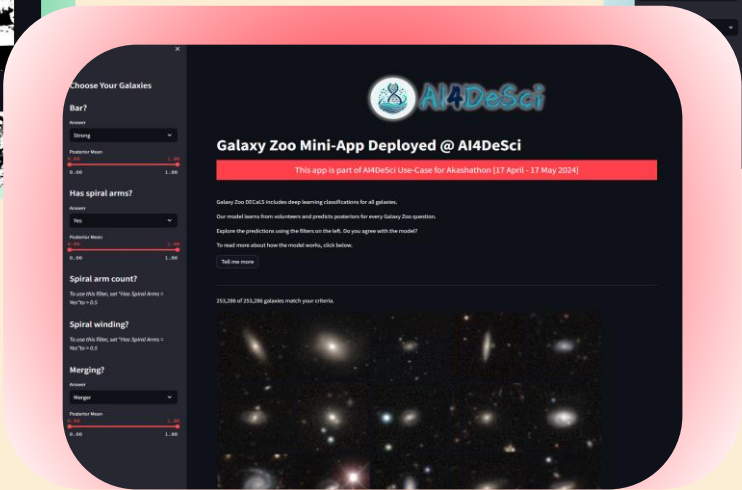
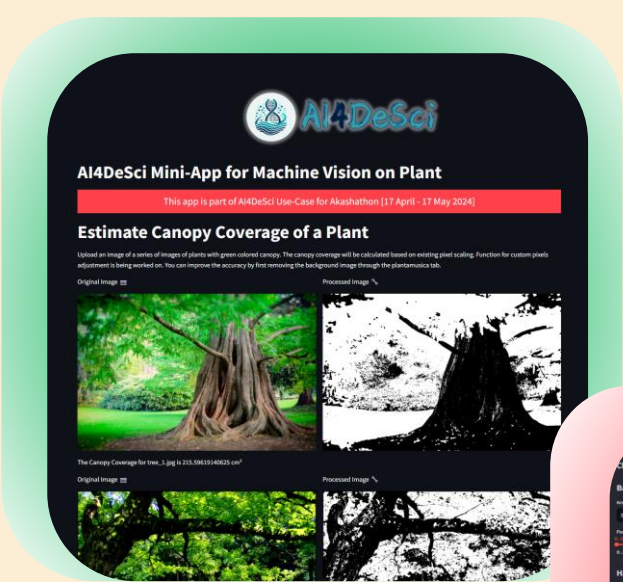
AI4DeSci Multi Agents Colab Workspaces



AI4DeSci Agents - AgentVerse Integration

11/21

*To illustrate the utility of our GPU-powered Science Crowdsourcing,
We Deployed several GPU use cases for :
For Rendering & Machine Vision
For Computation and ML Fitting
For AI Inferences with Images and Audio*



Use-Case Examples with 2 Collaboration groups:
akash_wg-collab and akash_sig-collab

As admin

Sign Up

Warning: JupyterHub seems to be served over an unsecured HTTP connection. We strongly recommend enabling HTTPS for JupyterHub.

Username:

akash_admin

Password:

akashathonadmin2024

Confirm password:

akashathonadmin2024

Create User

Login with an existing user.

As user

Sign Up

Warning: JupyterHub seems to be served over an unsecured HTTP connection. We strongly recommend enabling HTTPS for JupyterHub.

The signup was successful! You can now go to the home page and log in to the system.

Username:

akash

Password:

akashathon2024

Confirm password:

akashathon2024

Create User

Login with an existing user.

Everyone can Sign-Up,
Colab initiator can manage group members

Each Collab Project can have their
own colab server

jupyterhub Home Token Admin

akash_admin Logout

Search users

> Manage Groups

User	Admin	Server	Last Activity	Running	Actions
Add Users			Start All Stop All	Shutdown Hub	
akash_admin	admin		2 minutes ago	Stop Server Access Server	Edit User
akash_wg-collab			Never	Start Server Spawn Page	Edit User

User

adminfalse

auth_state

created3 hours ago

groupscollaborative

kinduser

last_activity

nameakash_wg-collab

pending

rolesuser

server

Server

last_activity

name

pending

progress_url/hub/api/users/akash_wg-collab/server/progress

readyfalse

started

state

stoppedtrue

uri/user/akash_wg-collab/

user_options

akash_sig-collab			Never	Start Server Spawn Page	Edit User
akash1			Never	Start Server Spawn Page	Edit User
akash2			Never	Start Server Spawn Page	Edit User
akash3			Never	Start Server Spawn Page	Edit User
akash4			Never	Start Server Spawn Page	Edit User
akash5			Never	Start Server Spawn Page	Edit User

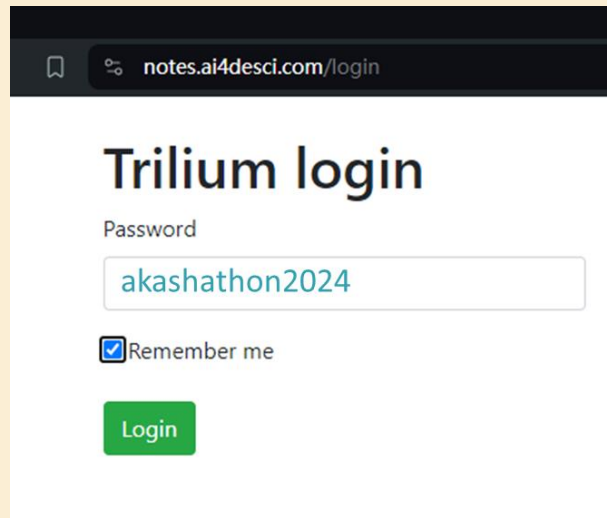
Displaying 0-8

Disclaimer : public version is still a bit faulty when generating spawn server

13/21

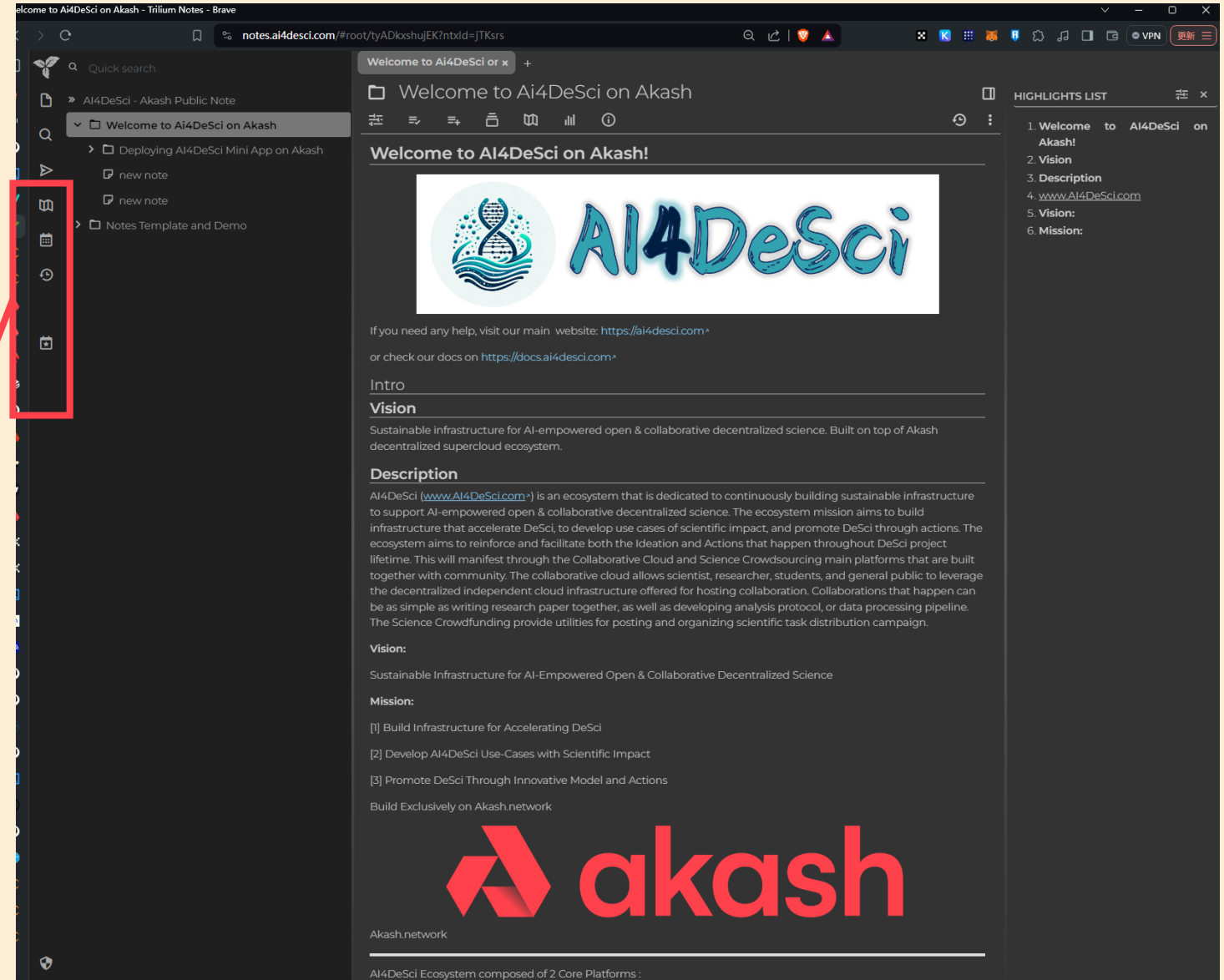
Full-control of the self-hosted trillium note server.

*Each colab project can
have their own password
protected notes space*



The image shows a web browser window with the URL `notes.ai4desci.com/login`. The page has a white background with the title "Trilium login". Below the title is a "Password" label and a text input field containing the text "akashathon2024". There is a checkbox labeled "Remember me" which is checked. At the bottom is a green "Login" button.

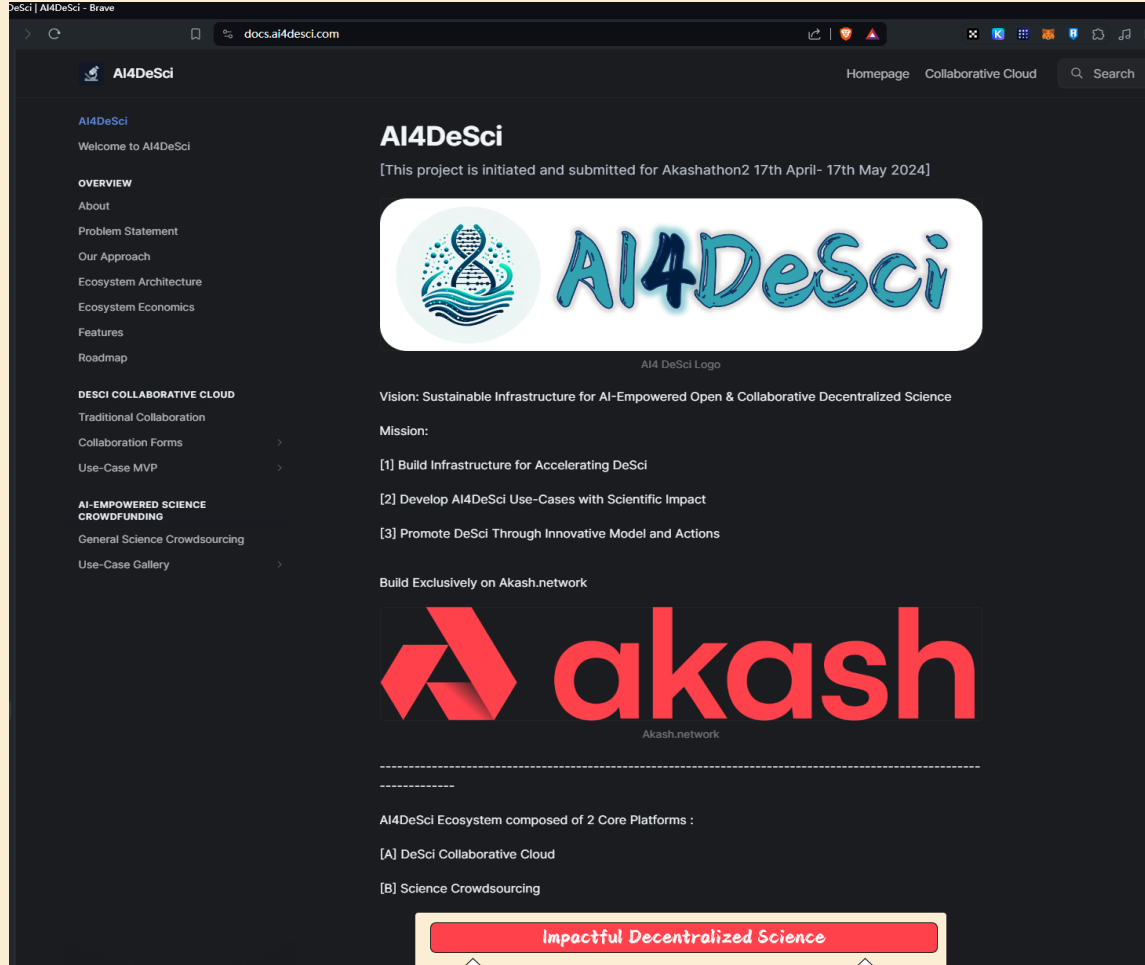
*Sync functions with DB
server and with unlimited
desktop instances*



The image is a screenshot of a web browser showing the AI4DeSci website. The browser's address bar shows the URL `notes.ai4desci.com/#root/tyADkxshuJEK?nbtld=jTKsrs`. The website has a dark theme. On the left is a sidebar with a "Quick search" bar and a list of folders: "AI4DeSci - Akash Public Note", "Welcome to AI4DeSci on Akash", "Deploying AI4DeSci Mini App on Akash", "new note", "new note", and "Notes Template and Demo". A red box highlights a vertical menu in the sidebar with icons for home, search, and other functions. A red arrow points from this menu to the login form in the previous block. The main content area has a header "Welcome to AI4DeSci on Akash" and a large logo for "AI4DeSci" featuring a DNA helix and the text "AI4DeSci". Below the logo is a paragraph of text: "If you need any help, visit our main website: <https://ai4desci.com> or check our docs on <https://docs.ai4desci.com>". There are sections for "Intro", "Vision", and "Description". The "Vision" section describes the ecosystem's mission. The "Description" section explains the ecosystem's goals and the collaborative cloud infrastructure. At the bottom, there is a large red "akash" logo and the text "Akash.network".

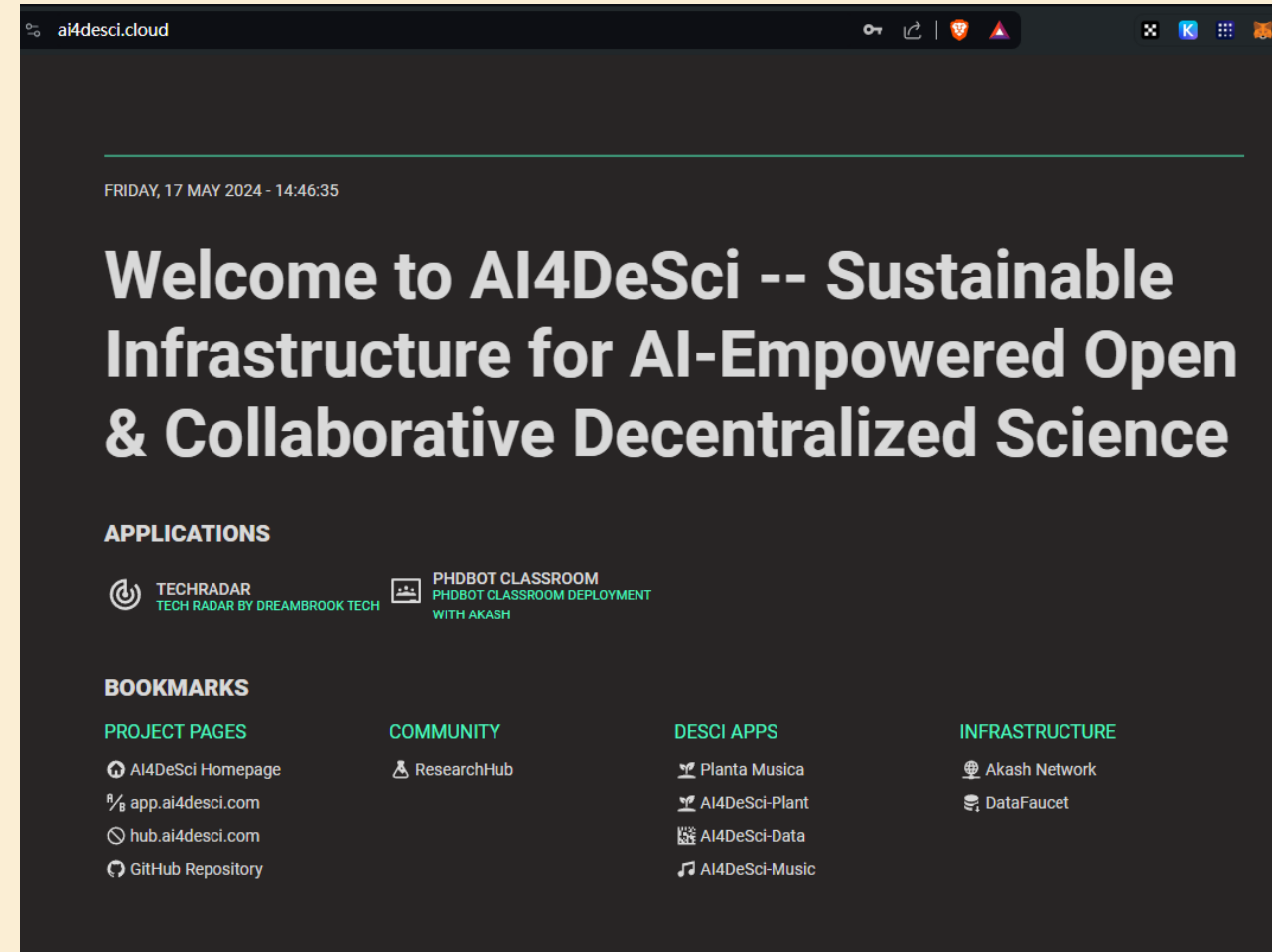
docs.ai4desci.com

Official project documentation powered by gitbook. Community Roadmap, Whitepaper, and Engineering manual are hosted here



ai4desci.cloud

To keep track of the infrastructures developed over time. A Catalog of links for the AI4DeSci ecosystems.



provider.ai4desci.network

AI4DeSci Deployments Overview

*Snapshots of our currently deployed
Infrastructure For
AI4DeSci Ecosystem
We are building ...*

Your Account

● You have **13 active deployments**

Total resources leased

36.5 CPU
 3 GPU
 44.2 GB RAM
 96.7 GB Disk

Total cost

US\$572.79 / month

Providers

provider.greenepin.cloud

provider.ai4desci.network

provider.medc1.com

provider.a6000.mon.obl.akash.pub

provider.hurricane.akash.pub

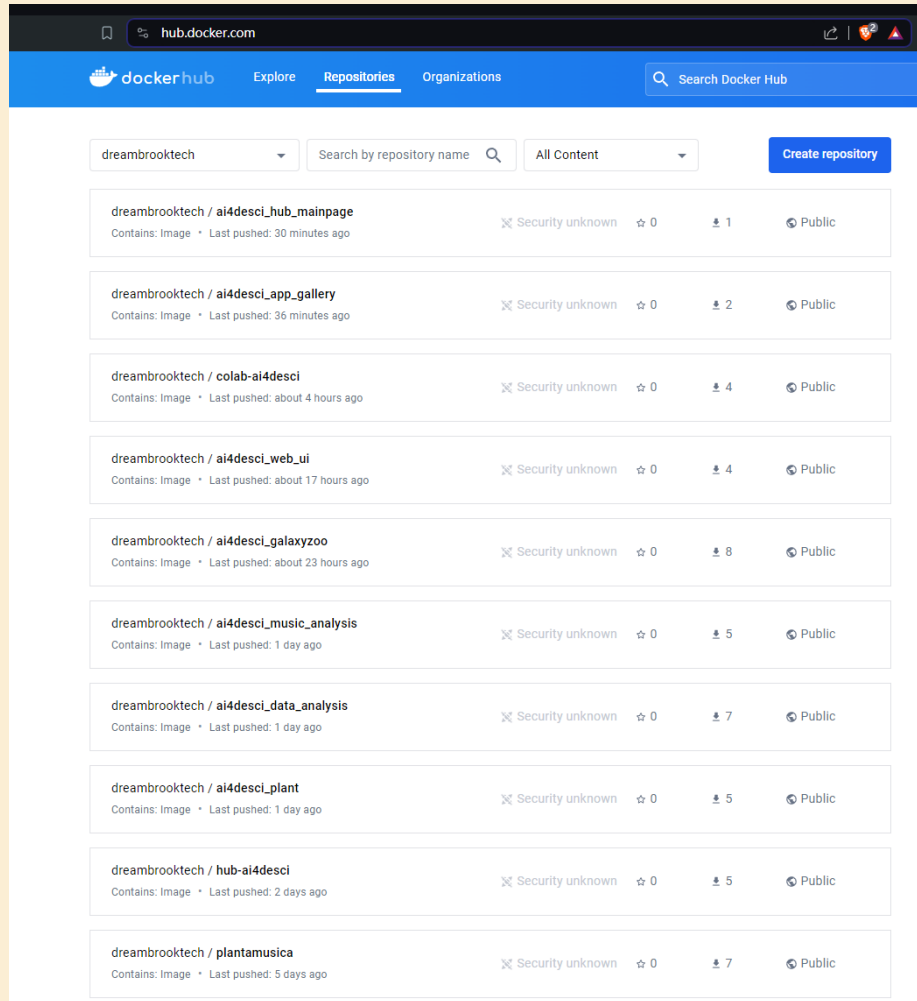
*Trivia: These are our own resources
connected to the platform ^^*

You have 13 active deployments

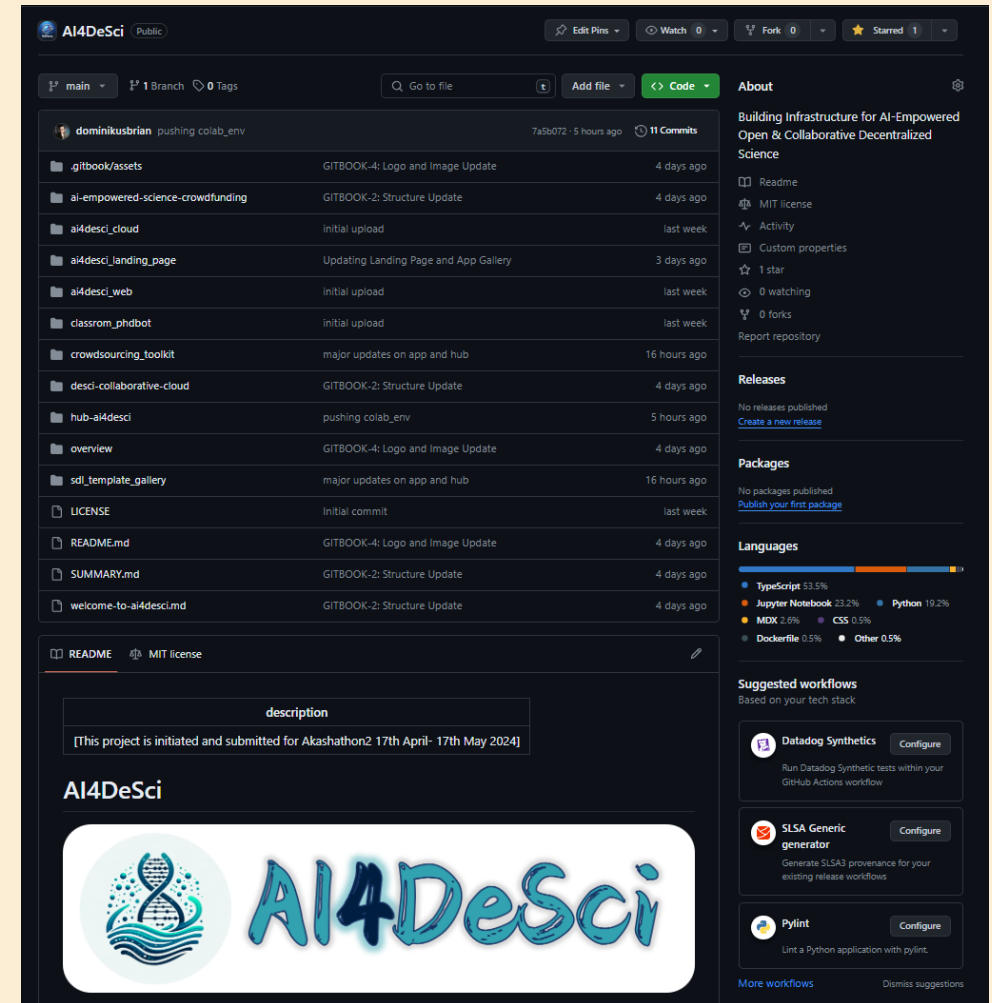
Specs	Name	Time left	Balance	Cost	Leases
1 cpu 1.07 GB 1.07 GB	al4desci_app... - 16345020	~about 1 month	US\$2.89 ⓘ	US\$2.66 / month ⓘ	prov...desci.network ●
1 cpu 1.07 GB 1.07 GB	al4desci_hub... - 16344959	~about 1 month	US\$2.89 ⓘ	US\$2.81 / month ⓘ	prov...endepin.cloud ●
8 cpu 8.59 GB 25.77 GB	colab-al4desci - 16342651	~12 days	US\$8.55 ⓘ	US\$21.73 / month ⓘ	prov...desci.network ●
0.5 cpu 2.15 GB 2.15 GB	al4desci_web_ui - 16334747	~about 1 month	US\$2.82 ⓘ	US\$2.84 / month ⓘ	prov...endepin.cloud ●
2 cpu 2.15 GB 1.07 GB	al4desci_miniapp8 - 16331094	~15 days	US\$2.72 ⓘ	US\$5.36 / month ⓘ	prov...endepin.cloud ●
2 cpu 2.15 GB 1.07 GB	al4desci_miniapp3 - 16330303	~15 days	US\$2.70 ⓘ	US\$5.47 / month ⓘ	prov...endepin.cloud ●
2 cpu 1 gpu 2.15 GB 1.07 GB	al4desci_miniapp1 - 16328616	~2 days ⚠	US\$5.46 ⓘ	US\$84.30 / month ⓘ	provider.medc1.com ●
2 cpu 1 gpu 2.15 GB 1.07 GB	al4desci_miniapp2 - 16328222	~2 days ⚠	US\$6.21 ⓘ	US\$83.83 / month ⓘ	prov...ane.akash.pub ●
4 cpu 2.15 GB 1.07 GB	colab-space - 16326922	~8 days	US\$2.51 ⓘ	US\$9.10 / month ⓘ	prov...endepin.cloud ●
1 cpu 1.07 GB 5.37 GB	notes-al4desci - 16325697	~about 1 month	US\$2.77 ⓘ	US\$2.78 / month ⓘ	prov...desci.network ●

Rows per page 10 Page 1 of 2 < Previous 1 2 Next >

*All the deployments in AI4DeSci
are pre-packaged and
distributed through Docker Hub
to ensure Reproducibility*



*Source code are available for
the community and accessible
from our public GitHub
Repository*



AI4DeSci Tech Stack General Overview

Community & Economy

Ocean Data
Marketplace

Ghost / Next.js

Trilium Public
Notebook

ResearchHub
DeSci Community

Dev Zone

Streamlit

Label-studio

Slurm Workload
Manager

Jupyter Hub,
Lab, Notebook

Metaflow

oLLama

Python ML toolkits

Flyte

Scikit-learn

Keras

TensorFlow

PyTorch

Infrastructure

Jackal

Storj

Arweave

vLLM

Akash Decentralized Cloud
(CPUs + GPUs + IP + storages, ...)

Cloudflare

Netdata

Grafana

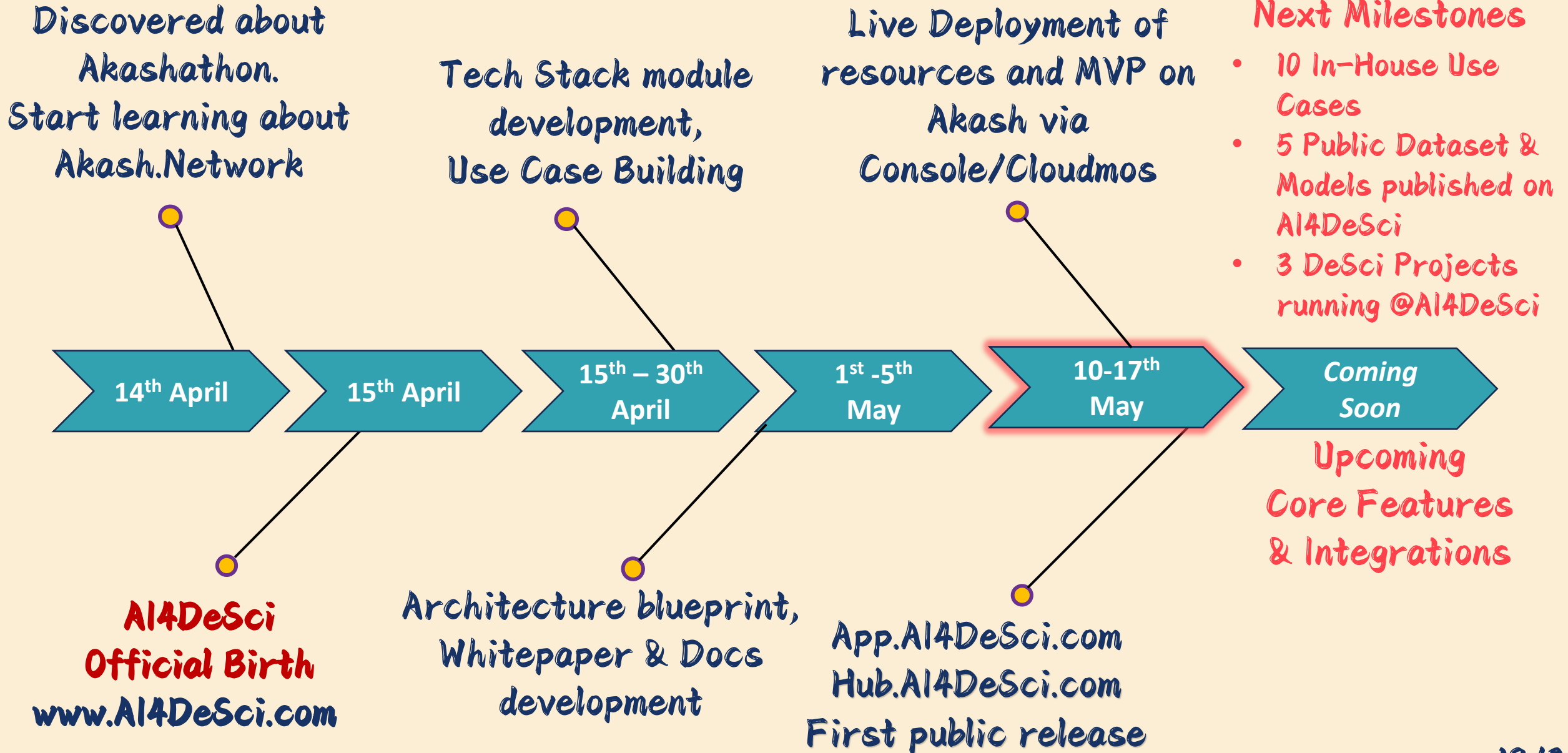
IBC

IPFS

Keplr

...

Roadmap for AI4DeSci @ Akashathon and beyond



Upcoming Core Features

Toward Decentralized HPC on Akash :

Start from proper slurm -jupyter integration for hub.ai4desci.com to have worker node across Akash Deployments

Modular mini-app builder and Automated Packaging + Deployment:

Utilizing streamlit components and label-studio SDK to allow for self-customization and auto-deployment of AI4DeSci mini-app on app.ai4desci.com

Real-World Use Case Quick Prototyping:

Work closely with ResearchHub team and community in developing Real-world DeSci use collaboration use-case.

Upcoming Integrations

DB-GPT for smart database

Flyte for ML/AI datastore

Metaflow for workflow reproducibility

Storj (for backup)

Jackal (waiting for v4)

OCEAN Protocol data marketplace

ResearchHub API for DeSci feed

Label Studio

Build molecular simulation use-case with OpenMM

Dify and other game-like blueprint to develop AI-Agents

...

More to come as use-cases and dev community grows

Observed Challenges with production deployments on Akash Ecosystem

Monitoring the health and status of distributed deployments is a challenge without integrated dashboard for status reporting.

Deployment instability when using reverse proxy is still questionable owing to the discrepancy in network performance of different provider, e.g. static, and dynamics, IP, TLS certificates, etc.

Persistent storage options reading often faulty and not available on most provider, which is seems due to error in attribute matching and not due to resource limitation.

more details will be properly documented and raised as issue or feature request through github ...

To be continued...



AI4DeSci



akash