Building UTxO-Optimized Dapps

Lars Brünjes & Marvin Bertin

Introduction

Outline

- What is a blockchain anyway?
- Smart contracts and DApps
- Accounting models - account based and EUTxO
- Advantages of the EUTxO-model

What is a Blockchain?

Blockchain - A Ledger in the Sky

Ledger

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Blockchain - A Ledger in the Sky

- **Decentralised!**
  - Everybody can participate.
  - Data is distributed.

Ledger

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- Write-only
  - Like writing with ink that becomes indelible once dried.
  - **Consensus** on the “dried” parts.

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Blockchain - A Ledger in the Sky

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  - Everybody can participate.
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  - Like writing with ink that becomes indelible once dried.
  - **Consensus** on the “dried” parts.
- All the fancy crypto is there to make this possible!

Ledger

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What are Smart Contracts & DApps?

“Vanilla” Cryptocurrency

- Digital signatures authorize payments.

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Smart Contracts

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“Vanilla” Cryptocurrency

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Smart Contracts

- Payment validity is determined by “arbitrary logic”
- “Arbitrary” data can be stored and processed.

DApps

- DApps (“decentralized apps”) are Apps interacting with the blockchain.
- They combine traditional components like a website and database with smart contracts and the ability to query the blockchain and submit transactions.
- They provide a user-friendly interface to the blockchain.
- Typical applications are DEX’s (“decentralized exchanges”), NFT marketplaces and multiplayer games, but we’ve only just begun to explore the realm of the possible.

Accounting Models: The Current Standard

The account-based model

- Used by Ethereum and others.

- Similar to how banks do it: Accounts have balances, and transactions decrease one balance and increase another accordingly.

- The state of the system is given by the current balance on each account.

- A transaction updates the balances.

Alice starts with ETH 100, Bob with ETH 50

Account	**Balance**
Alice	100
Bob	50
Charlie	0

Alice sends ETH 10 to Bob

Account	**Balance**
Alice	100
Bob	50
Charlie	0

→

Account	**Balance**
Alice	90
Bob	60
Charlie	0

Alice and Bob send ETH 55 each to Charlie

Account	Balance
Alice	100
Bob	50
Charlie	0

→

Account	Balance
Alice	90
Bob	60
Charlie	0

→

Account	Balance
Alice	35
Bob	5
Charlie	110

Smart contracts in the account-based model

- Accounts not only hold value, but also optional functions and data.

- A transaction calls a function of an account, which can call functions of other accounts. If one of those functions fails, the transaction fails.

- The functions can transfer value and modify data.

- Functions “see” the whole current state of the blockchain.

Accounting Models: Cardano’s (E)UTxO-Model

The UTxO-model

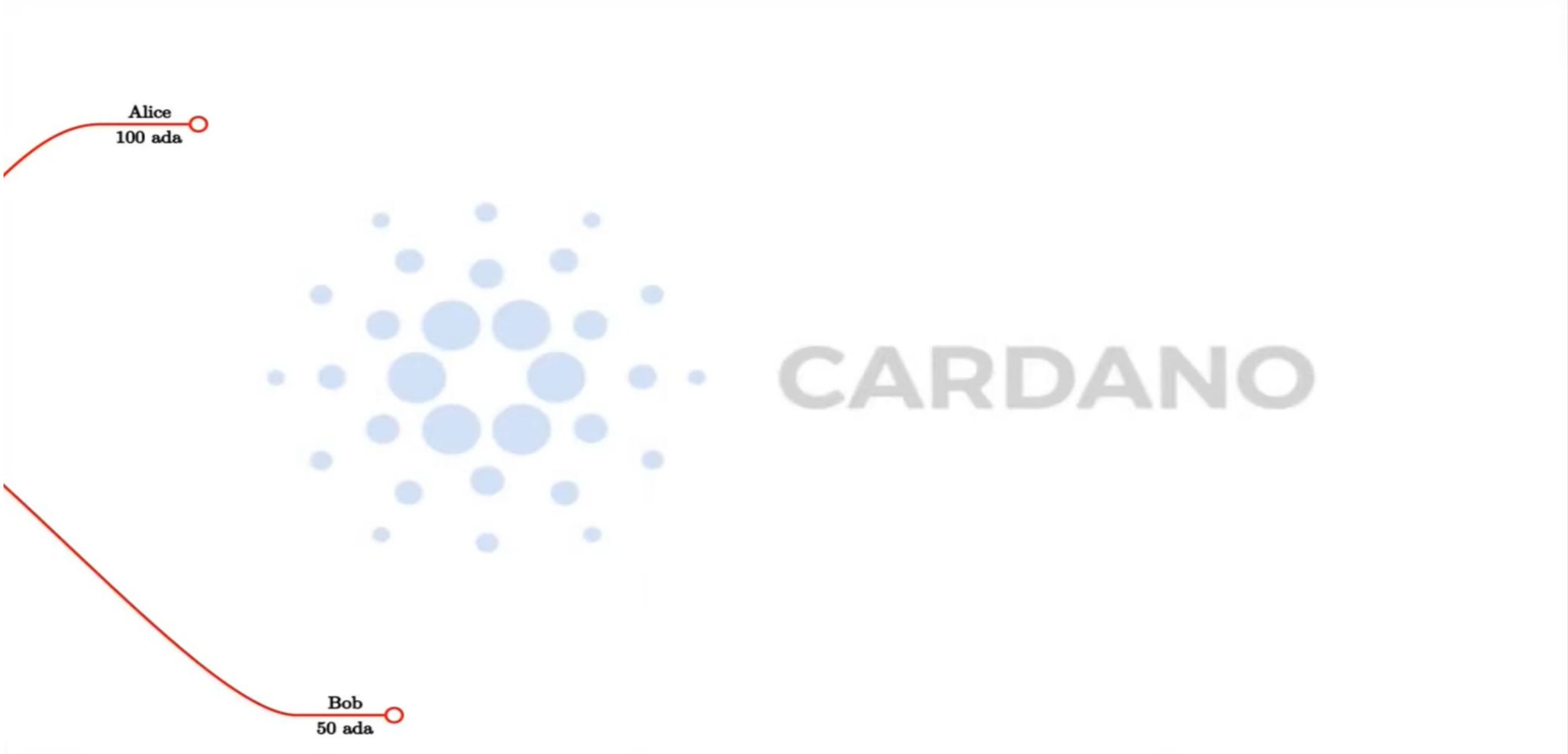
- Used by Bitcoin, Cardano and others.

- Somewhat similar to coins: Users control several UTxO’s (unspent transaction outputs), who have to be spent completely or not at all.

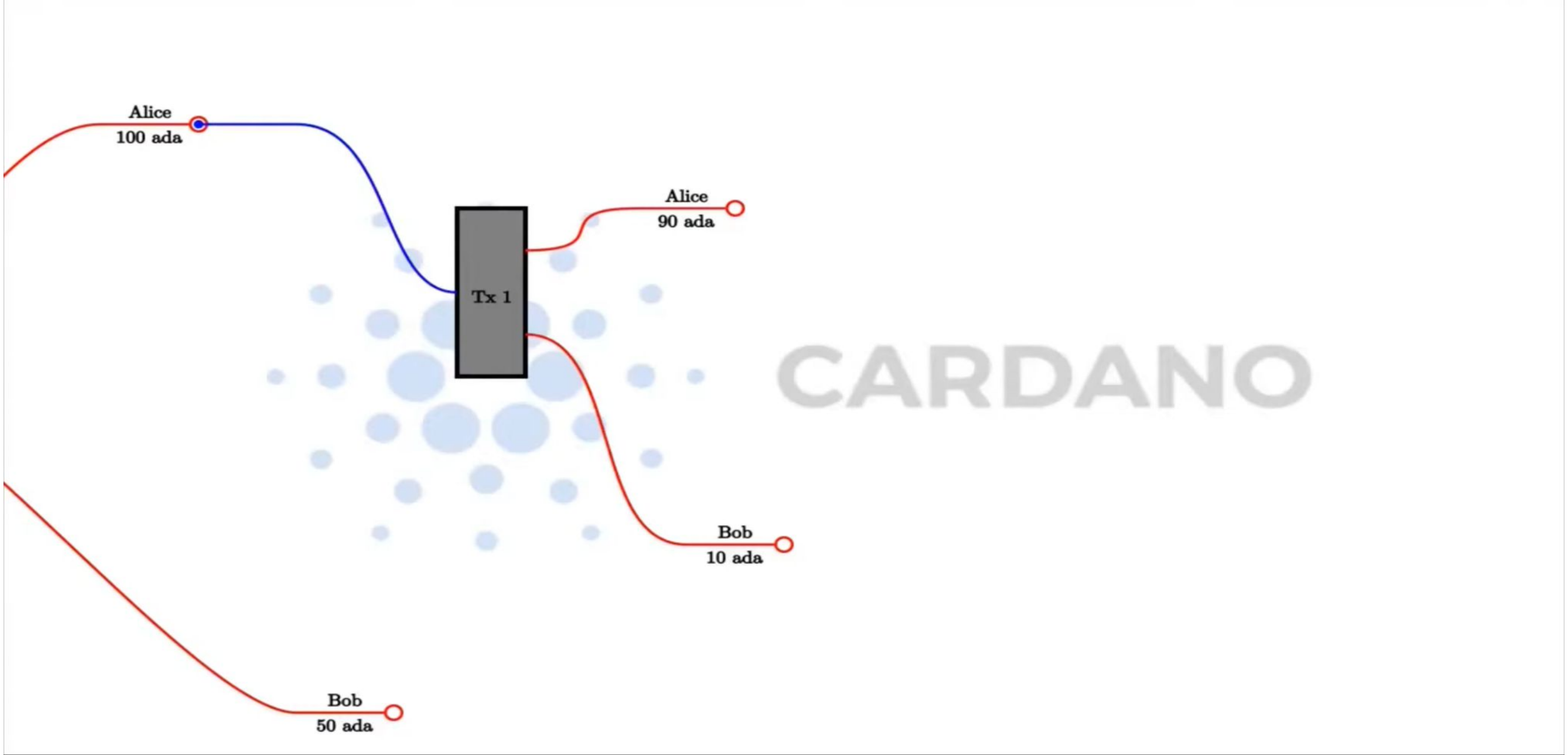
- The state of the system is given by the current set of UTxO’s.

- A transaction “spends” some UTxO’s and creates new ones, but never modifies anything else.

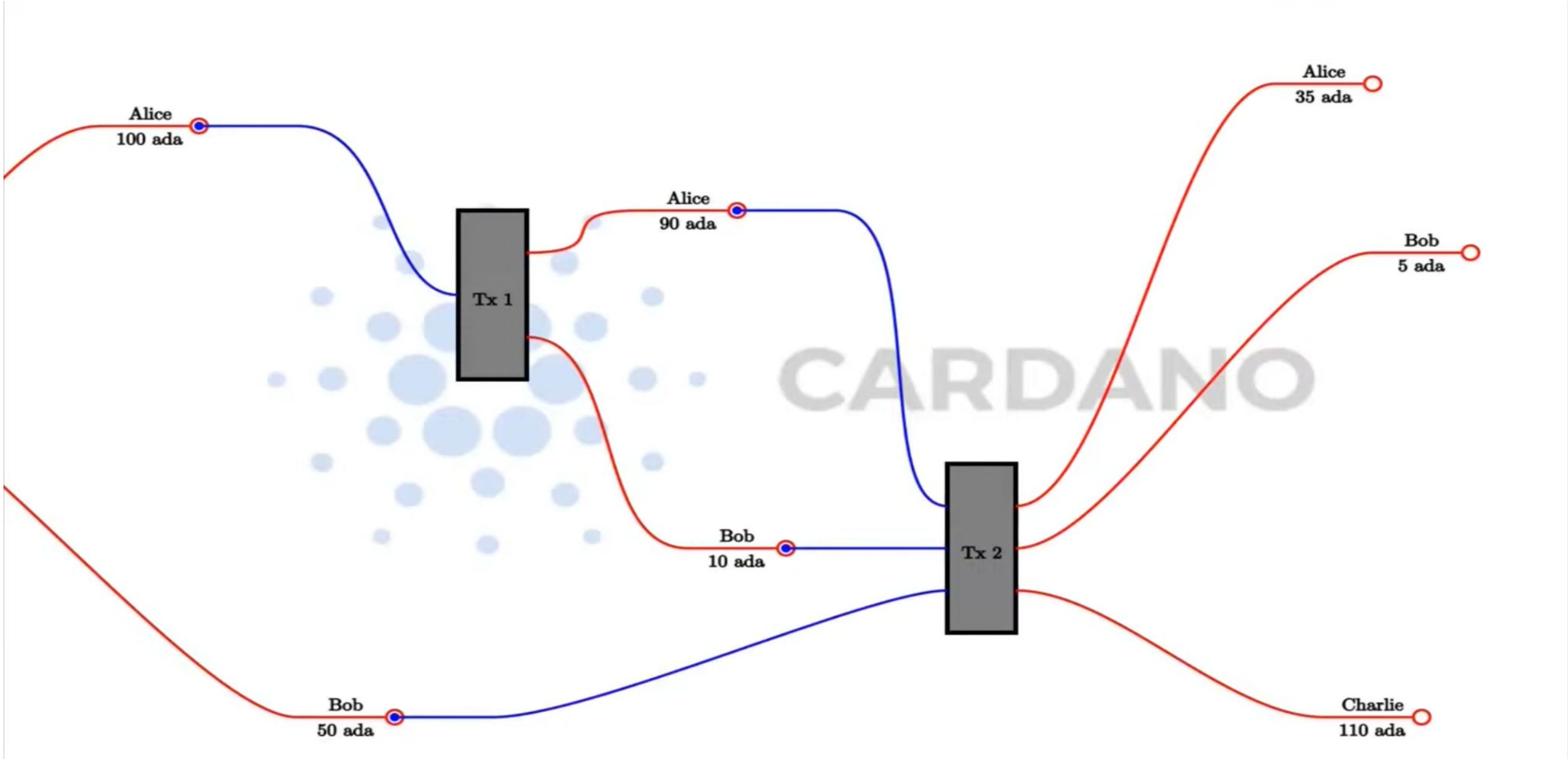
Alice starts with ₳100, Bob with ₳50



Alice sends ₳10 to Bob



Alice and Bob send ₳55 each to Charlie



The EUTxO-model (extended UTxO-model)

- Adds smart contract capability to Cardano.

- In addition to value, Cardano UTxO’s can optionally carry data.

- Instead of addresses given by cryptographic keys, UTxO’s can “sit” at addresses given by a “validator”, a piece of code.

- During validation, that code is executed in the context of the transaction being validated (and nothing else).

Advantages of the (E)UTxO-Model

Key differences between the models

Account based	**EUTxO**
Transactions modify balances and data “in place”.	Everything is immutable. All that changes is the UTxO-set.
Whether a transaction is valid or not depends of the state of the whole blockchain.	Validation context is the transaction with its inputs and outputs and nothing else.
The effect of a transaction is generally not know upon submission.	The effect of a transaction is deterministic and known upon submission.
Transaction can fail and still cost money.	Failing transactions are free.

Attractive properties of the EUTxO-model

- Since the validation context is restricted to a transaction with its inputs and outputs, it is much easier to understand and analyze what can and can not happen.

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- As long as transaction inputs and outputs do not overlap, they are independent, and their order does not matter.
- State can be split into many UTxO’s, facilitating concurrency and enabling Layer-2-technologies like Hydra.
- This makes writing correct and highly performant smart contracts much easier, provided they fully embrace the model.

How to build scalable UTxO-optimized DApps

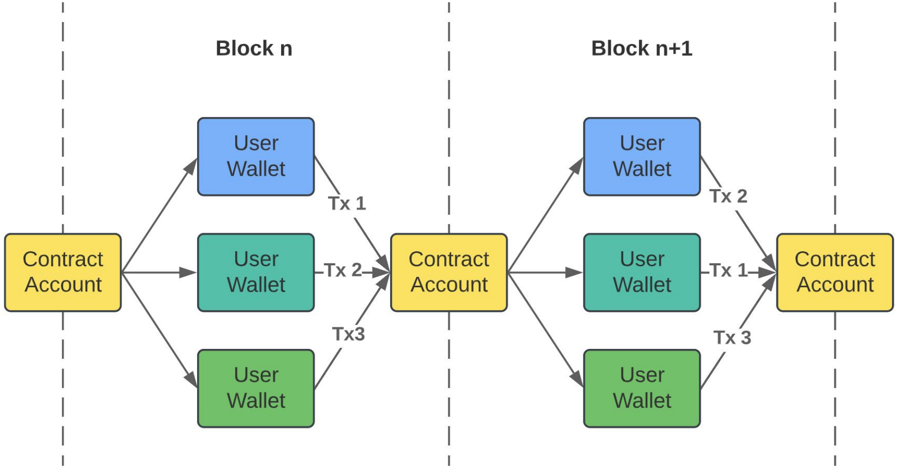
Most Web3 DApps are specifically designed for EVM account-base smart contracts

Account-based blockchains properties:

- Global state wallets & contracts
- Mutable account address
- Sequential single-threaded Tx
- On-chain computation
- Non-deterministic transactions

Web3 protocol architectures are design to fit EVM paradigm

- Liquidity pools
- AMMs
- Monolithic dapps



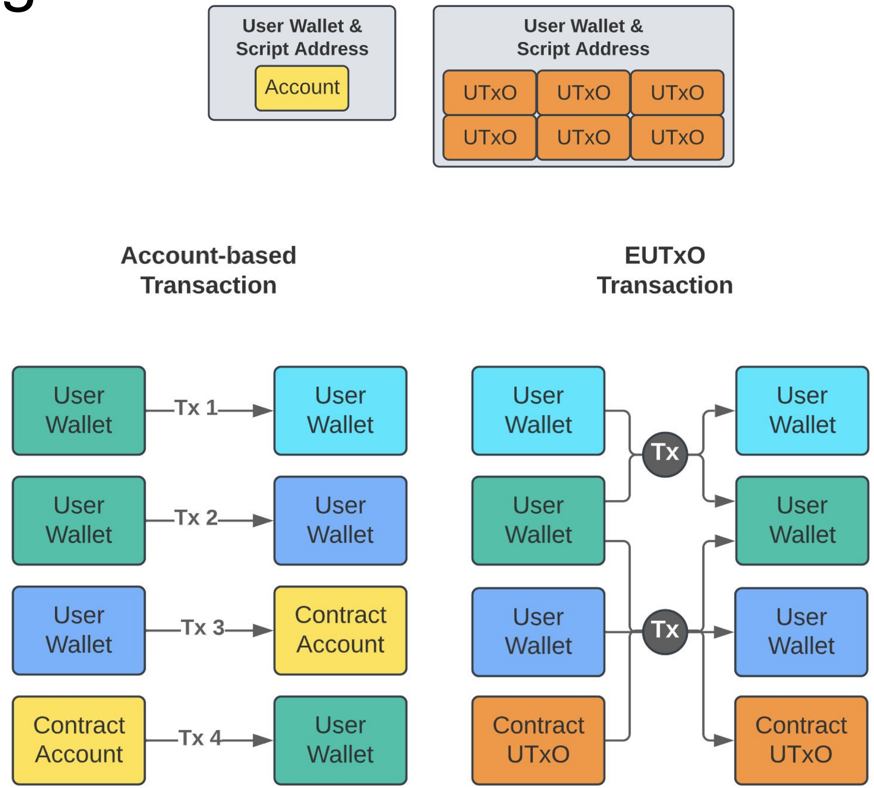
EUTxO blockchains like Cardano employ a fundamentally different smart contract paradigm

UTXO Properties

- Distributed state wallets & contracts
- Immutable UTxOs
- Transaction parallelism, multi-threaded
- Off-chain computation, onchain verification
- Transaction are deterministic

Key Advantages

- 1 UTxO Tx = many account Txs
- Transaction multitasking
- Transaction parallelism



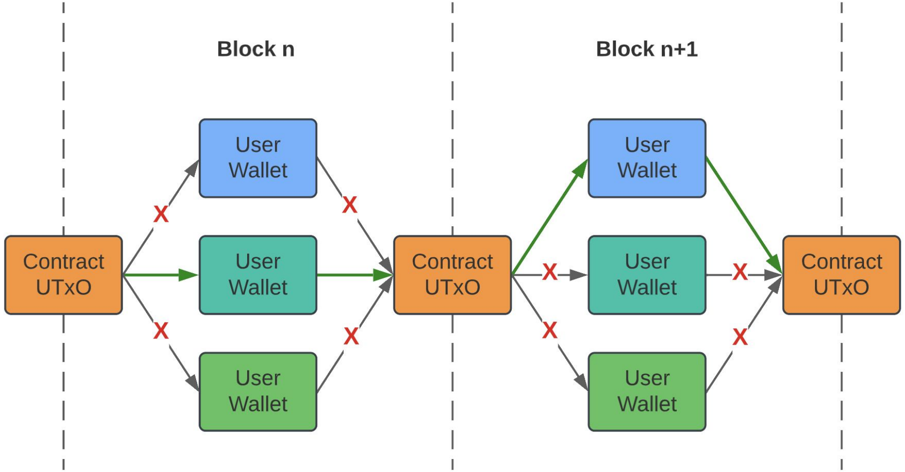
Copying EVM dapp architecture is leads to anti-patterns and poor performance

UTxO Contention

- A UTXO can be used once per block

Anti-patterns to avoid on Cardano

- Track state in a single UTxO (global state)
- Many users need to interact with one UTxO

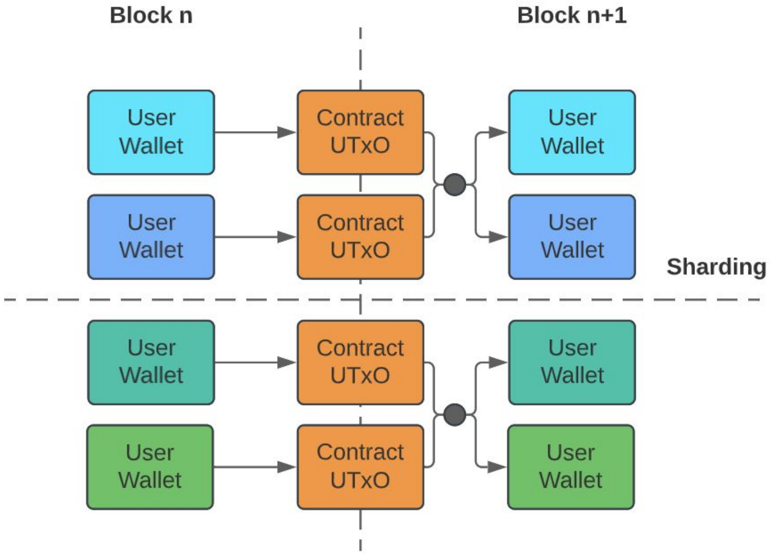


A complete redesign of dapp protocol is required to take advantage of UTxO's unique feature such as determinism, parallelism, scalability and composability

A UTxO-optimized design makes for simpler & more scalable DApps

Protocols architectures that benefit from UTxOs

- Highly parallelizable algorithms
- State fragmentation grows with number of users
- State machine models



UTxOs are very powerful. If used correctly allow to build both different and better dapps compared to EVM dapps. However, novel protocol designs must be embraced.

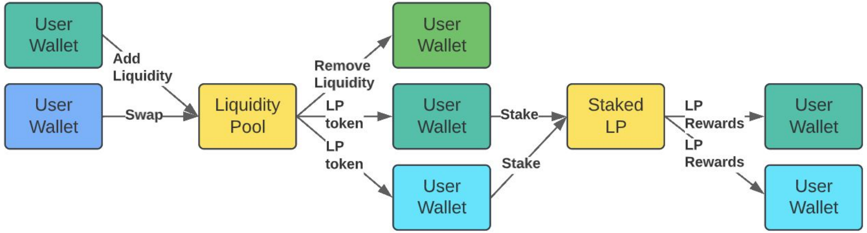
Most DApps on Cardano are inefficient designed because they are inspired by EVM protocols

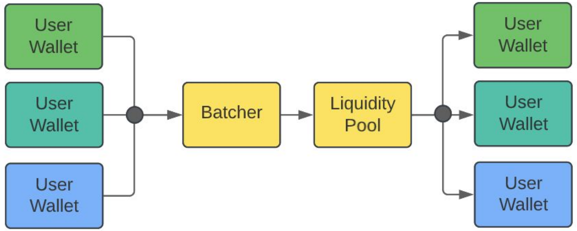
Automatic Market Maker (AMM) DEX is an anti-pattern on Cardano

- Liquidity pools => contention issues
- Yield LP tokens => unnecessary complexity
- Impermanent loss => pool artifact

Order batchers do not address root cause

- Add complexity
- Lead to centralization





Cardano devs need to unlearn EVM-based design and build dapps from the ground-up based on first principles.

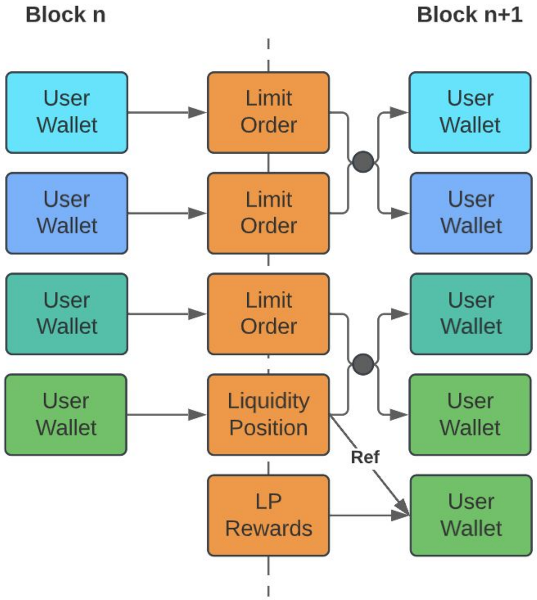
UTxO paradigm is very powerful if used correctly

Fragmentation smart contract state

- Each UTxO has 1 owner
- Split pools into individual liquidity positions
- Turn swaps into individual orders
- Replace LP token with UTxO reference

Fragmented dapp is easily compatible with Layer 2 solutions

- Hydra - Isomorphic State Channels
- ZK rollups - Zero-knowledge proofs



UTxO fragmentation must grow with number of users. UTxO-optimized dapps are especially compatible with layer-2 scaling solution

Order-Book: The ideal UTxO design pattern

2 Step Process

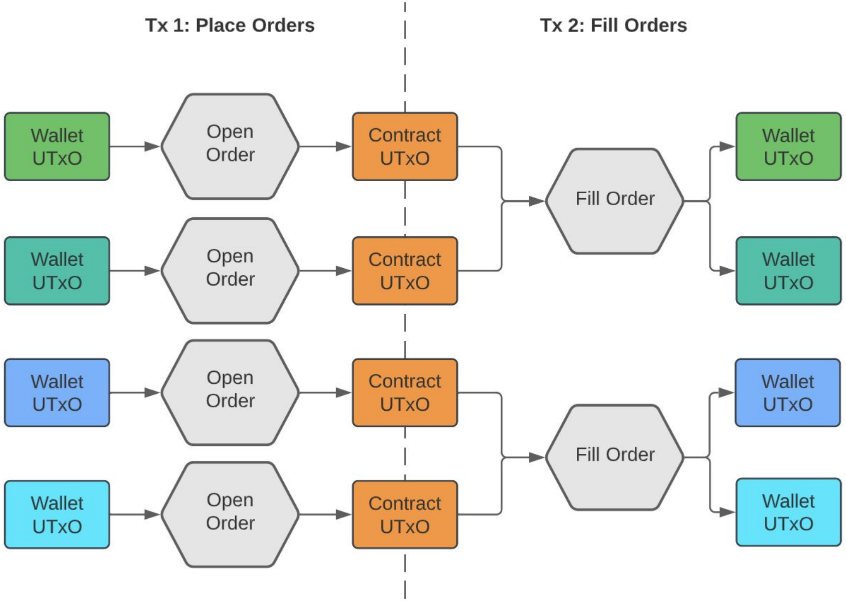
1) Users place orders on-chain

2) Off-chain bots match & process orders

Highly scalable & decentralized

- Decoupled order creation and processing
- Fully parallelizable user interaction
- Decentralized order processing

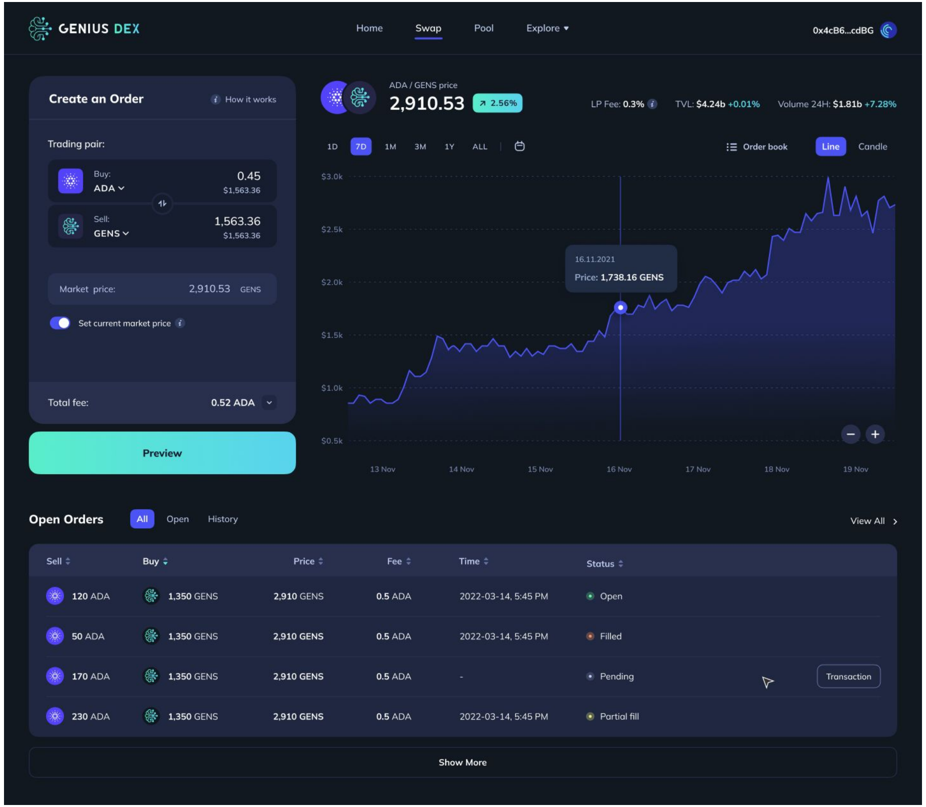
Maximize throughput without interference



Order-Book design pattern decouples the spending & the creation of script outputs, leading to a highly scalable and decentralized app.

Genius DApp Ecosystem

Genius DEX: highly parallelized, decentralized & scalable



Create an Order

Trading pair:

Buy: ADA 0.45 $1,563.36

Sell: GENS 1,563.36 $1,563.36

Market price: 2,910.53 GENS

Set current market price

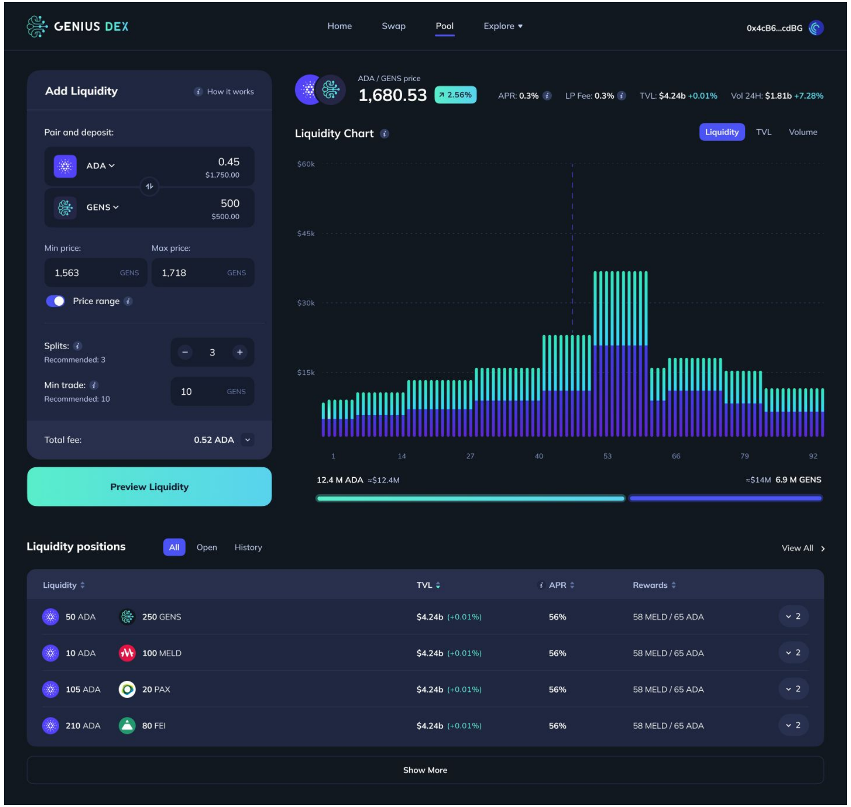
Total fee: 0.52 ADA

ADA / GENS price 2,910.53 ↗ 2.56%

LP Fee: 0.3% TVL: $4.24b +0.01% Volume 24H: $1.81b +7.28%

Open Orders

Sell	Buy	Price	Fee	Time	Status
120 ADA	1,350 GENS	2,910 GENS	0.5 ADA	2022-03-14, 5:45 PM	Open
50 ADA	1,350 GENS	2,910 GENS	0.5 ADA	2022-03-14, 5:45 PM	Filled
170 ADA	1,350 GENS	2,910 GENS	0.5 ADA	-	Pending
230 ADA	1,350 GENS	2,910 GENS	0.5 ADA	2022-03-14, 5:45 PM	Partial fill



Add Liquidity

Pair and deposit:

ADA 0.45 $1,750.00

GENS 500 $500.00

Min price: 1,563 GENS

Max price: 1,718 GENS

Price range

Splits: 3 Recommended: 3

Min trade: 10 GENS Recommended: 10

Total fee: 0.52 ADA

ADA / GENS price 1,680.53 ↗ 2.56%

APR: 0.3% LP Fee: 0.3% TVL: $4.24b +0.01% Vol 24H: $1.81b +7.28%

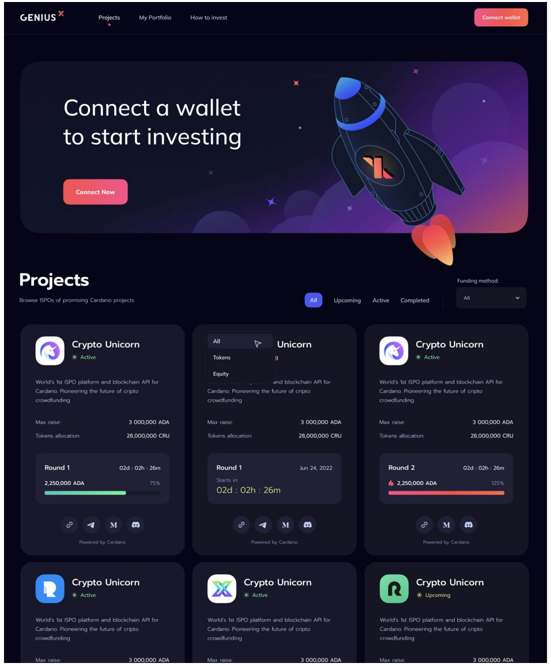
Liquidity Chart

12.4 M ADA ≈$12.4M ≈$14M 6.9 M GENS

Liquidity positions

Liquidity		TVL	APR	Rewards	
50 ADA	250 GENS	$4.24b (+0.01%)	56%	58 MELD / 65 ADA	⌄ 2
10 ADA	100 MELD	$4.24b (+0.01%)	56%	58 MELD / 65 ADA	⌄ 2
105 ADA	20 PAX	$4.24b (+0.01%)	56%	58 MELD / 65 ADA	⌄ 2
210 ADA	80 FEI	$4.24b (+0.01%)	56%	58 MELD / 65 ADA	⌄ 2

Genius X Launchpad: the most advanced and regulatory-compliant Token Sale Platform on Cardano



Connect a wallet
to start investing

Projects

Browse ISPOs of promising Cardano projects

Crypto Unicorn · Active

World's 1st ISPO platform and blockchain API for Cardano. Pioneering the future of cripto crowdfunding

Max raise: 3 000,000 ADA
Tokens allocation: 28,000,000 CRU

Round 1 · 02d : 02h : 26m
2,250,000 ADA · 75%

Powered by Cardano

Unicorn

and blockchain API for Cardano. Pioneering the future of cripto crowdfunding

Max raise: 3 000,000 ADA
Tokens allocation: 28,000,000 CRU

Round 1 · Jun 24, 2022
Starts in:
02d : 02h : 26m

Powered by Cardano

Crypto Unicorn · Active

World's 1st ISPO platform and blockchain API for Cardano. Pioneering the future of cripto crowdfunding

Max raise: 3 000,000 ADA
Tokens allocation: 28,000,000 CRU

Round 2 · 02d : 02h : 26m
2,250,000 ADA · 125%

Powered by Cardano

Crypto Unicorn · Active

World's 1st ISPO platform and blockchain API for Cardano. Pioneering the future of cripto crowdfunding

Max raise: 3 000,000 ADA

Crypto Unicorn · Active

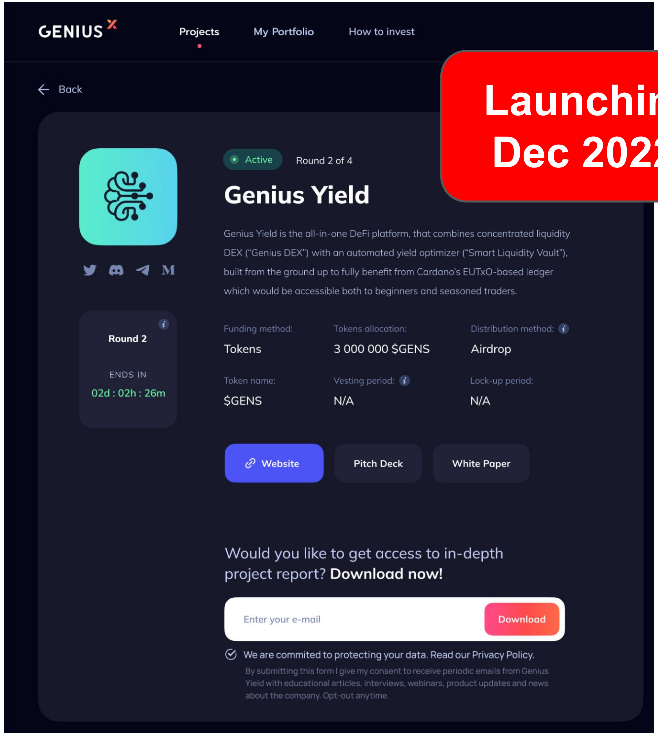
World's 1st ISPO platform and blockchain API for Cardano. Pioneering the future of cripto crowdfunding

Max raise: 3 000,000 ADA

Crypto Unicorn · Upcoming

World's 1st ISPO platform and blockchain API for Cardano. Pioneering the future of cripto crowdfunding

Max raise: 3 000,000 ADA



Active · Round 2 of 4

Genius Yield

Genius Yield is the all-in-one DeFi platform, that combines concentrated liquidity DEX ("Genius DEX") with an automated yield optimizer ("Smart Liquidity Vault"), built from the ground up to fully benefit from Cardano's EUTxO-based ledger which would be accessible both to beginners and seasoned traders.

Round 2
ENDS IN
02d : 02h : 26m

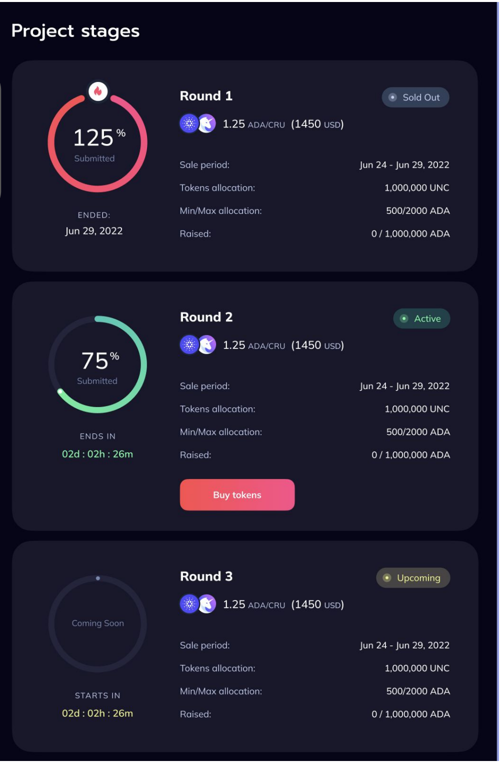
Funding method: Tokens
Tokens allocation: 3 000 000 $GENS
Distribution method: Airdrop
Token name: $GENS
Vesting period: N/A
Lock-up period: N/A

Would you like to get access to in-depth project report? **Download now!**

We are commited to protecting your data. Read our Privacy Policy.

By submitting this form I give my consent to receive periodic emails from Genius Yield with educational articles, interviews, webinars, product updates and news about the company. Opt-out anytime.

Launching Dec 2022!



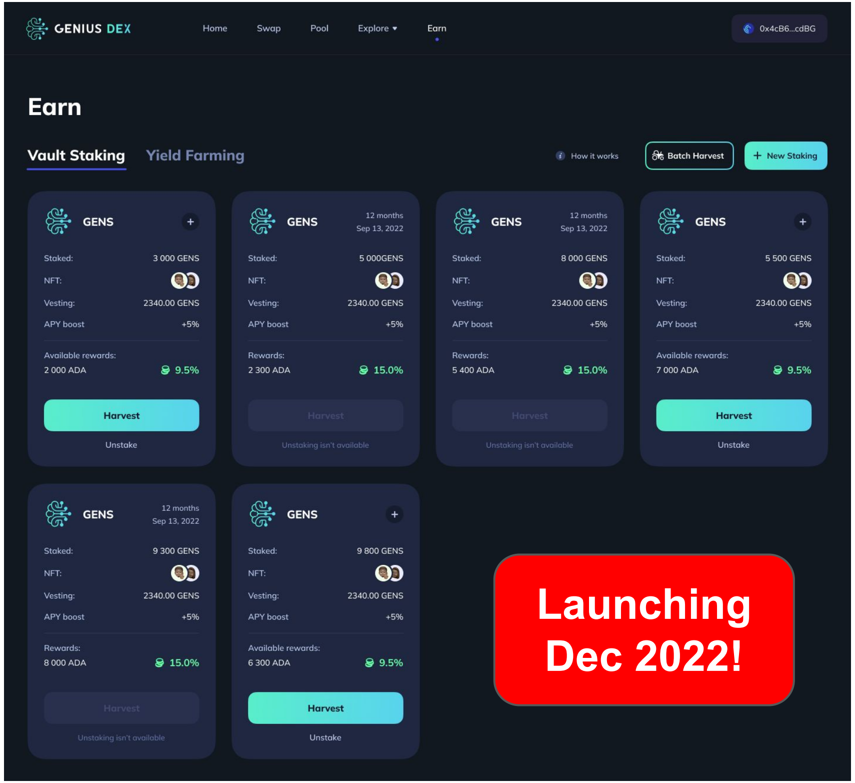
Project stages

Round 1 · Sold Out
125 % Submitted
ENDED:
Jun 29, 2022
1.25 ADA/CRU (1450 USD)
Sale period: Jun 24 - Jun 29, 2022
Tokens allocation: 1,000,000 UNC
Min/Max allocation: 500/2000 ADA
Raised: 0 / 1,000,000 ADA

Round 2 · Active
75% Submitted
ENDS IN
02d : 02h : 26m
1.25 ADA/CRU (1450 USD)
Sale period: Jun 24 - Jun 29, 2022
Tokens allocation: 1,000,000 UNC
Min/Max allocation: 500/2000 ADA
Raised: 0 / 1,000,000 ADA

Round 3 · Upcoming
Coming Soon
STARTS IN
02d : 02h : 26m
1.25 ADA/CRU (1450 USD)
Sale period: Jun 24 - Jun 29, 2022
Tokens allocation: 1,000,000 UNC
Min/Max allocation: 500/2000 ADA
Raised: 0 / 1,000,000 ADA

Genius Yield Farming & Staking: earn triple yield!



GENIUS DEX

Home Swap Pool Explore ▾ Earn

0x4cB6...cdBG

Earn

Vault Staking Yield Farming

How it works | Batch Harvest | + New Staking

GENS +
Staked: 3 000 GENS
NFT:
Vesting: 2340.00 GENS
APY boost +5%
Available rewards:
2 000 ADA 9.5%
Harvest
Unstake

GENS 12 months Sep 13, 2022
Staked: 5 000GENS
NFT:
Vesting: 2340.00 GENS
APY boost +5%
Rewards:
2 300 ADA 15.0%
Harvest
Unstaking isn't available

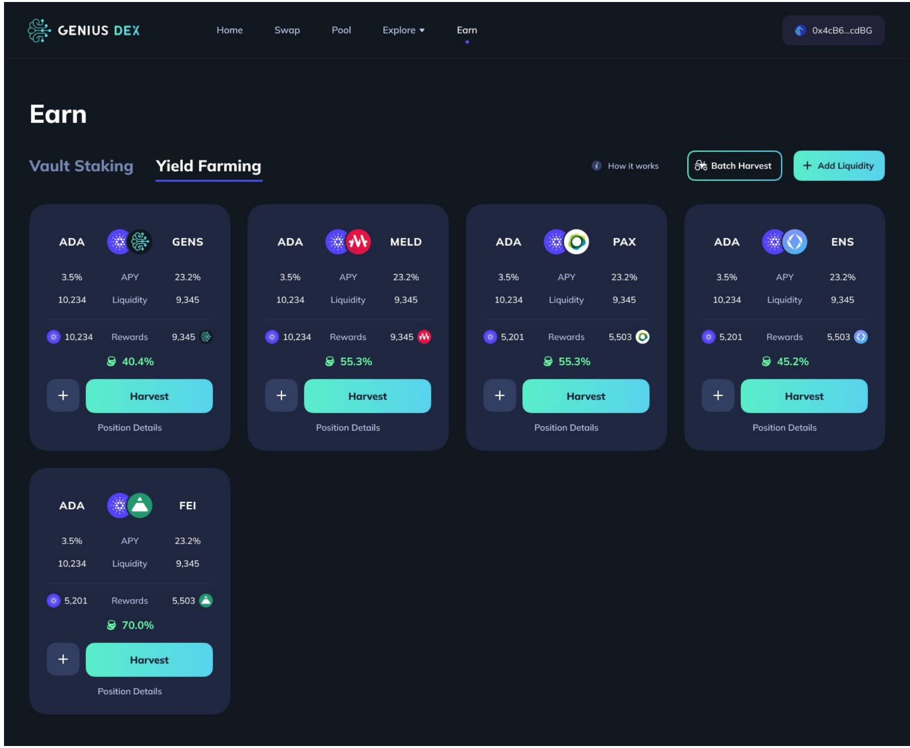
GENS 12 months Sep 13, 2022
Staked: 8 000 GENS
NFT:
Vesting: 2340.00 GENS
APY boost +5%
Rewards:
5 400 ADA 15.0%
Harvest
Unstaking isn't available

GENS +
Staked: 5 500 GENS
NFT:
Vesting: 2340.00 GENS
APY boost +5%
Available rewards:
7 000 ADA 9.5%
Harvest
Unstake

GENS 12 months Sep 13, 2022
Staked: 9 300 GENS
NFT:
Vesting: 2340.00 GENS
APY boost +5%
Rewards:
8 000 ADA 15.0%
Harvest
Unstaking isn't available

GENS +
Staked: 9 800 GENS
NFT:
Vesting: 2340.00 GENS
APY boost +5%
Available rewards:
6 300 ADA 9.5%
Harvest
Unstake

Launching Dec 2022!



GENIUS DEX

Home Swap Pool Explore ▾ Earn

0x4cB6...cdBG

Earn

Vault Staking **Yield Farming**

How it works | Batch Harvest | + Add Liquidity

ADA GENS
3.5% APY 23.2%
10,234 Liquidity 9,345
10,234 Rewards 9,345
40.4%
+ Harvest
Position Details

ADA MELD
3.5% APY 23.2%
10,234 Liquidity 9,345
10,234 Rewards 9,345
55.3%
+ Harvest
Position Details

ADA PAX
3.5% APY 23.2%
10,234 Liquidity 9,345
5,201 Rewards 5,503
55.3%
+ Harvest
Position Details

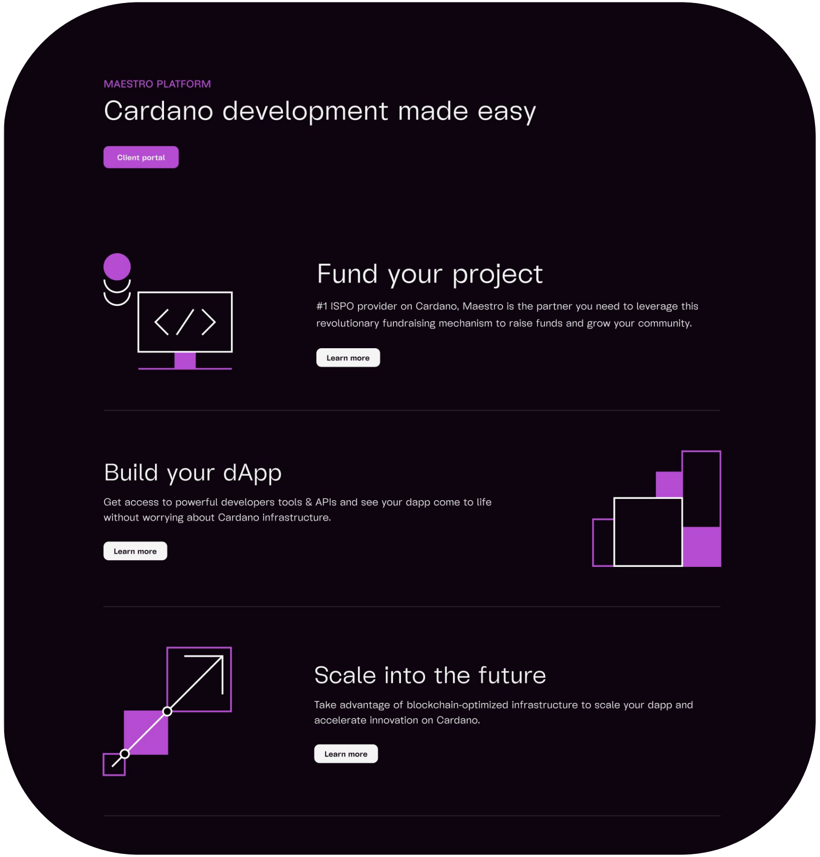
ADA ENS
3.5% APY 23.2%
10,234 Liquidity 9,345
5,201 Rewards 5,503
45.2%
+ Harvest
Position Details

ADA FEI
3.5% APY 23.2%
10,234 Liquidity 9,345
5,201 Rewards 5,503
70.0%
+ Harvest
Position Details

Genius’ blockchain infrastructure is powered by Maestro!

Fund, build & scale
The developer
platform for Cardano

Maestro



MAESTRO PLATFORM

Cardano development made easy

Fund your project

#1 ISPO provider on Cardano, Maestro is the partner you need to leverage this revolutionary fundraising mechanism to raise funds and grow your community.

Build your dApp

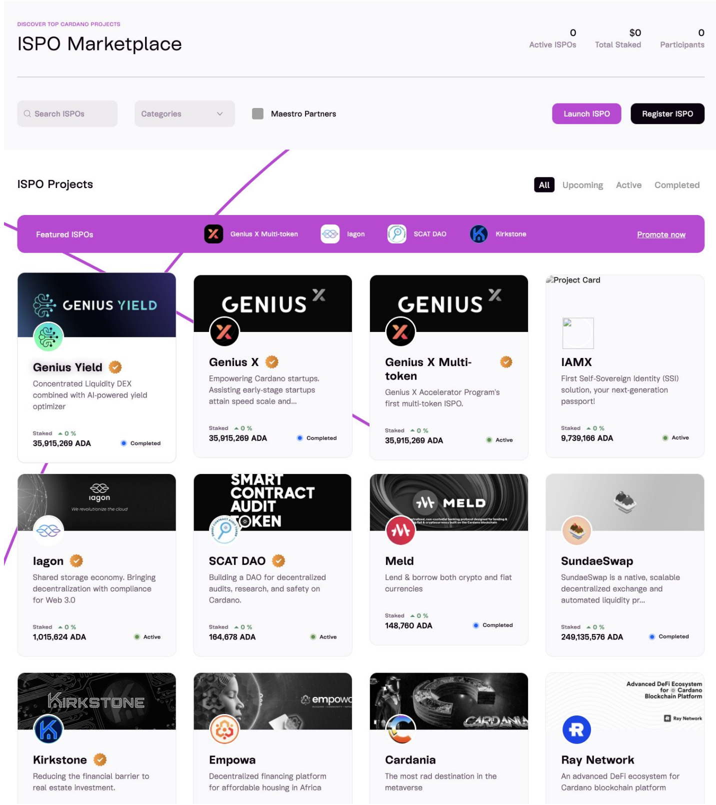
Get access to powerful developers tools & APIs and see your dapp come to life without worrying about Cardano infrastructure.

Scale into the future

Take advantage of blockchain-optimized infrastructure to scale your dapp and accelerate innovation on Cardano.

Cardano's 1st ISPO Marketplace!

Launching Nov 2022!



DISCOVER TOP CARDANO PROJECTS

ISPO Marketplace

0	$0	0
Active ISPOs	Total Staked	Participants

Search ISPOs | Categories | □ Maestro Partners | Launch ISPO | Register ISPO

ISPO Projects

All | Upcoming | Active | Completed

Featured ISPOs: Genius X Multi-token | Iagon | SCAT DAO | Kirkstone | Promote now

Genius Yield
Concentrated Liquidity DEX combined with AI-powered yield optimizer
Staked ▲ 0 %
35,915,269 ADA ● Completed

Genius X
Empowering Cardano startups. Assisting early-stage startups attain speed scale and...
Staked ▲ 0 %
35,915,269 ADA ● Completed

Genius X Multi-token
Genius X Accelerator Program's first multi-token ISPO.
Staked ▲ 0 %
35,915,269 ADA ● Active

Project Card
IAMX
First Self-Sovereign Identity (SSI) solution, your next-generation passport!
Staked ▲ 0 %
9,739,166 ADA ● Active

Iagon
Shared storage economy. Bringing decentralization with compliance for Web 3.0
Staked ▲ 0 %
1,015,624 ADA ● Active

SCAT DAO
Building a DAO for decentralized audits, research, and safety on Cardano.
Staked ▲ 0 %
164,678 ADA ● Active

Meld
Lend & borrow both crypto and fiat currencies
Staked ▲ 0 %
148,760 ADA ● Completed

SundaeSwap
SundaeSwap is a native, scalable decentralized exchange and automated liquidity pr...
Staked ▲ 0 %
249,135,576 ADA ● Completed

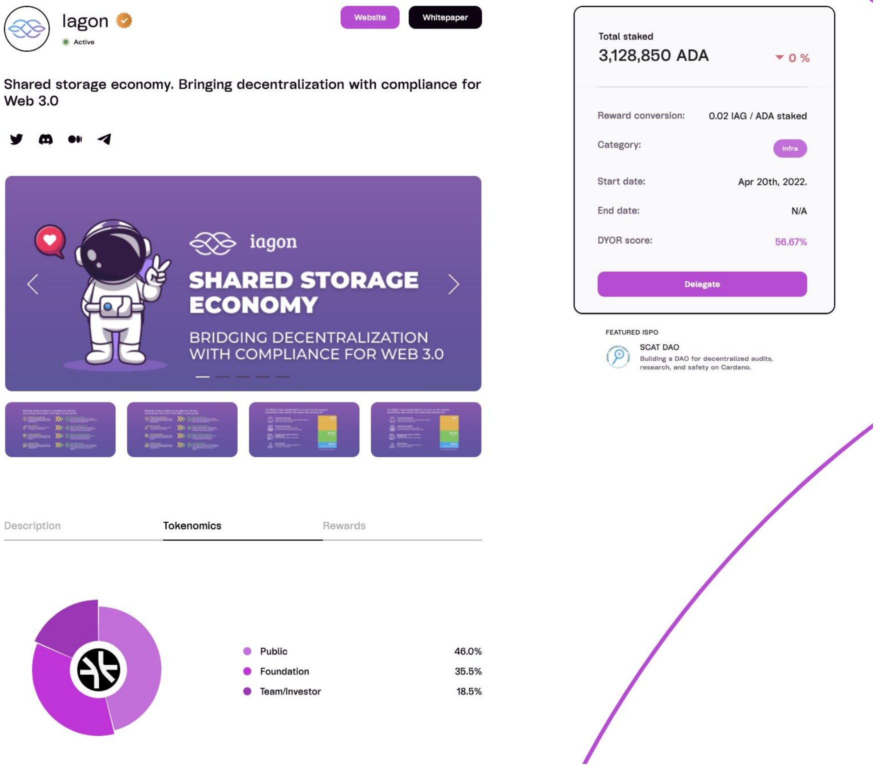
Kirkstone
Reducing the financial barrier to real estate investment.

Empowa
Decentralized financing platform for affordable housing in Africa

Cardania
The most rad destination in the metaverse

Ray Network
An advanced DeFi ecosystem for Cardano blockchain platform

GENIUS YIELD
GENIUS X
iagon
We revolutionize the cloud
SMART CONTRACT AUDIT TOKEN
MELD
KIRKSTONE
empowa
CARDANIA
Advanced DeFi Ecosystem for Cardano Blockchain Platform
Ray Network



Iagon
● Active

Website | Whitepaper

Shared storage economy. Bringing decentralization with compliance for Web 3.0

iagon
SHARED STORAGE ECONOMY
BRIDGING DECENTRALIZATION WITH COMPLIANCE FOR WEB 3.0

Description | Tokenomics | Rewards

● Public	46.0%
● Foundation	35.5%
● Team/Investor	18.5%

Total staked
3,128,850 ADA ▼ 0 %

Reward conversion:	0.02 IAG / ADA staked
Category:	Infra
Start date:	Apr 20th, 2022.
End date:	N/A
DYOR score:	56.67%

Delegate

FEATURED ISPO
SCAT DAO
Building a DAO for decentralized audits, research, and safety on Cardano.

Thank You!

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geniusyield.co