

Blockchain **Solution Designer** Course

in collaboration with Bocconi University

ZeroLab



Università
Bocconi
MILANO

Algorand

INTRO

Welcome! I am Alessio and my team and I are behind this course.

We are thrilled to have you here. This is a 6 parts introduction to Blockchain, from the perspective of Solutions designers.

No coding experience is required, but if you want to continue, it might come in handy.

During this course you will learn the theory behind Blockchain and why it is such a fundamental in modern business networks, and a great opportunity for young entrepreneurs.

You will also build a full **Dapp** to connect your wallet and create NFTs.

We hope you will enjoy this material!

Dr. Alessio Bonti

THE BLOCKCHAIN TEAM



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The **ZeroLab** mission is to leave the planet in a better state than we found it.

It is led by industry hardened individuals and awarded academics that want to make a difference.



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Blockchain 101

> An introduction to everything blockchain

By Dr. Alessio Bonti & Jason Pham



AGENDA

- **Introduction**
- **History of Blockchain**
- **Definition**
- **Characteristics**
- **Different types**
- **Blockchain Examples**

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Introduction

Business Networks, Wealth and Markets, and how it all combines.



BUSINESS AND MARKET

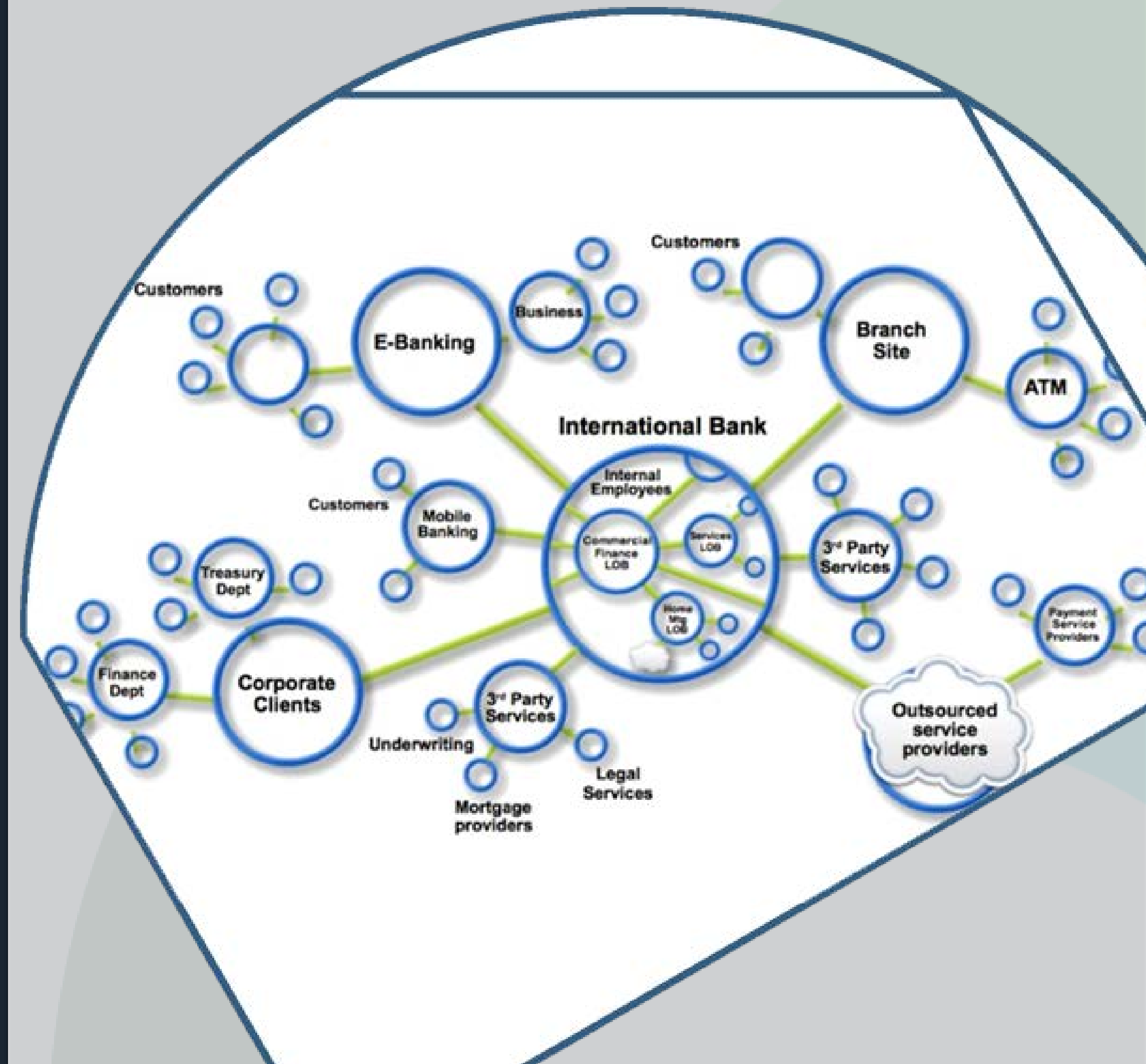
Business Networks benefit from connectivity

- Participants are customers, suppliers, banks, partners
- Cross geography & regulatory boundary

Wealth is generated by the flow of goods & services across business network in transactions and contracts

Markets are central to this process:

- Public (fruit market, car auction), or
- Private (supply chain financing, bonds)



ASSETS

Value is generated when assets are transferred.

Anything that is capable of being owned or controlled to produce value, is an asset.

We have two fundamental types of assets.

Tangible and Intangible.

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Tangible assets are simple, like houses, or a car. They exist physically.



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Intangible assets can be :

- **Financial** , eg bonds
- **Intellectual** , eg patents
- **Digital** , eg music or videos



LEDGERS , TRANSACTIONS AND CONTRACTS

For hundreds of years, business and markets kept on running on more or less modern **Ledgers** . Whether this was electronic or on paper, it has not changed much.

Each business would own its own **ledger**.

An asset would be transferred into or out of the ledger through a **transaction**. For example, Alex sells Bob a car.

Contracts are rules that specify how these transactions happen. For example, a sale contract would expect Bob to pay Alex for the car, and Alex passing the ownership of the car once the payment is made.

Blockchain is the first real attempt at breaking the hundreds years old ledger system.



DEFINITION

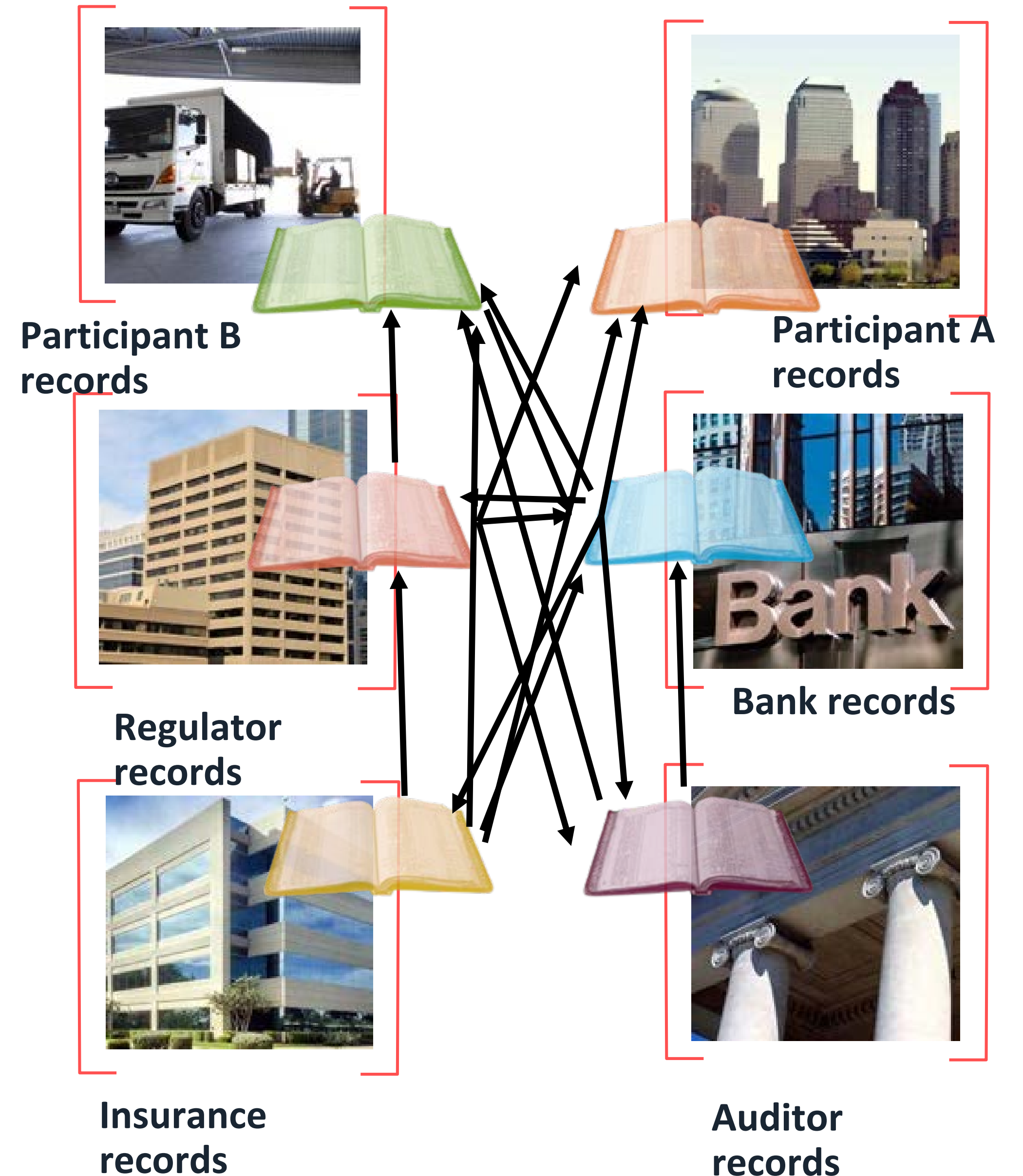
What is a blockchain - “A system in which a **record** of **transactions** made in bitcoin or another cryptocurrency are maintained across several computers that are linked in a **peer-to-peer** network.”

By the Oxford Language Dictionary

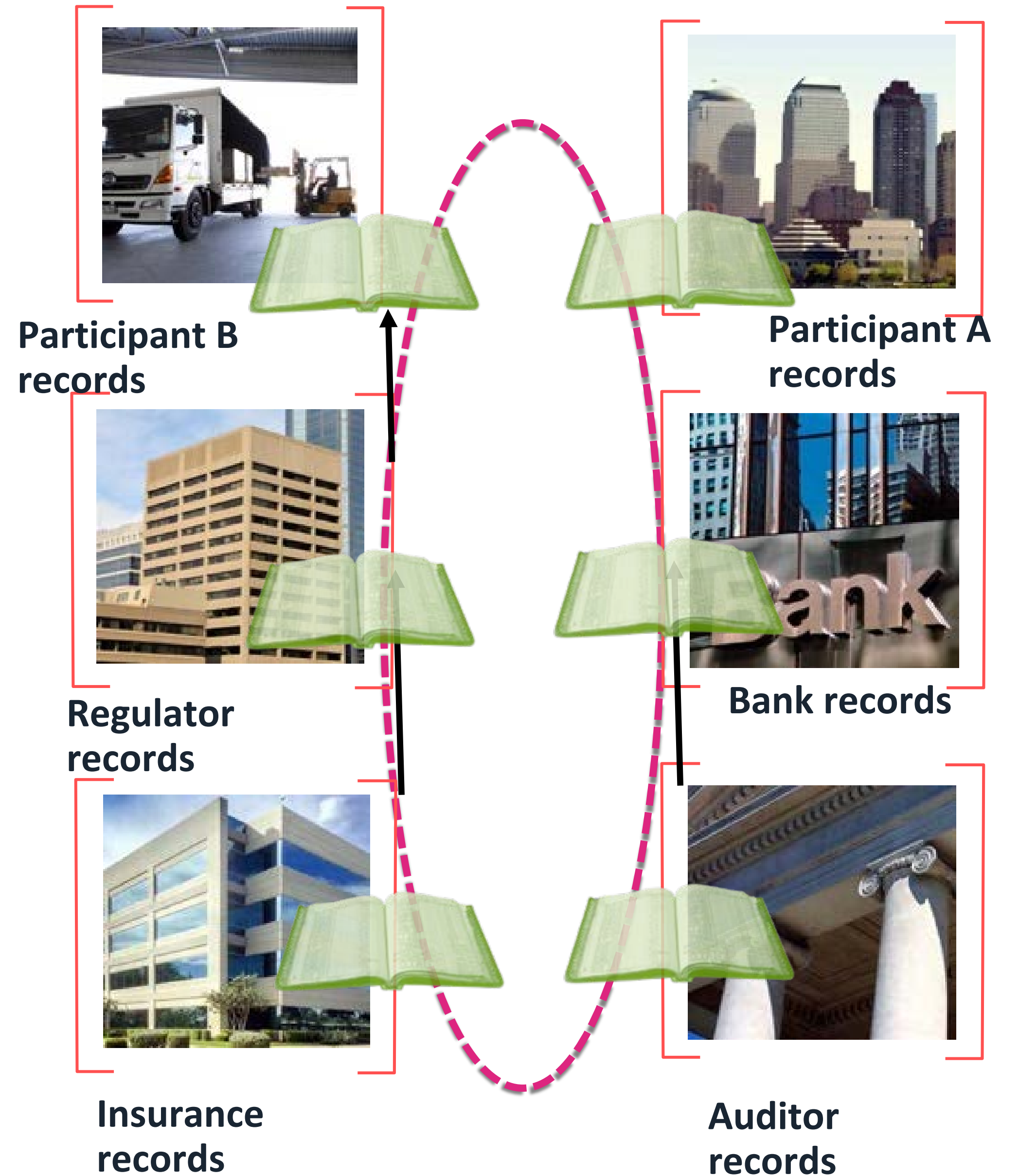
What is a blockchain = “That **crappy database** you use when you **don't trust anyone**”

By Awesome Stranger at Blockchain Meetup

Any typical day, this is what the business network is aiming to achieve. The whole system is **inefficient, expensive and vulnerable.**



Blockchain solves this problem through the use of one **Shared** and **Replicated ledger** with **consensus**, **provenance**, **immutability** and **finality**.



BLOCKCHAIN TIMELINE

A brief history of the evolution of blockchain.

1990 The theoretical works of blockchain

Conceptual and theoretical works regarding a “time-stamp digital document” were conducted in 1991 by Stuart Haber and Scott Stornetta.

2009 ETHEREUM 1.0

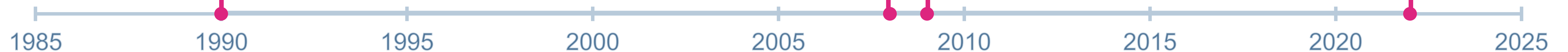
The first blockchain platform that introduces the smart contract concept

2008 BITCOIN

The first blockchain platform built by Satoshi Nakamoto.

2022 MORE THAN 1000 BLOCKCHAIN PLATFORMS

The transaction volume reached the peak in Q2 2021 at approximately \$4 trillion. Blockchain technology use also explodes.

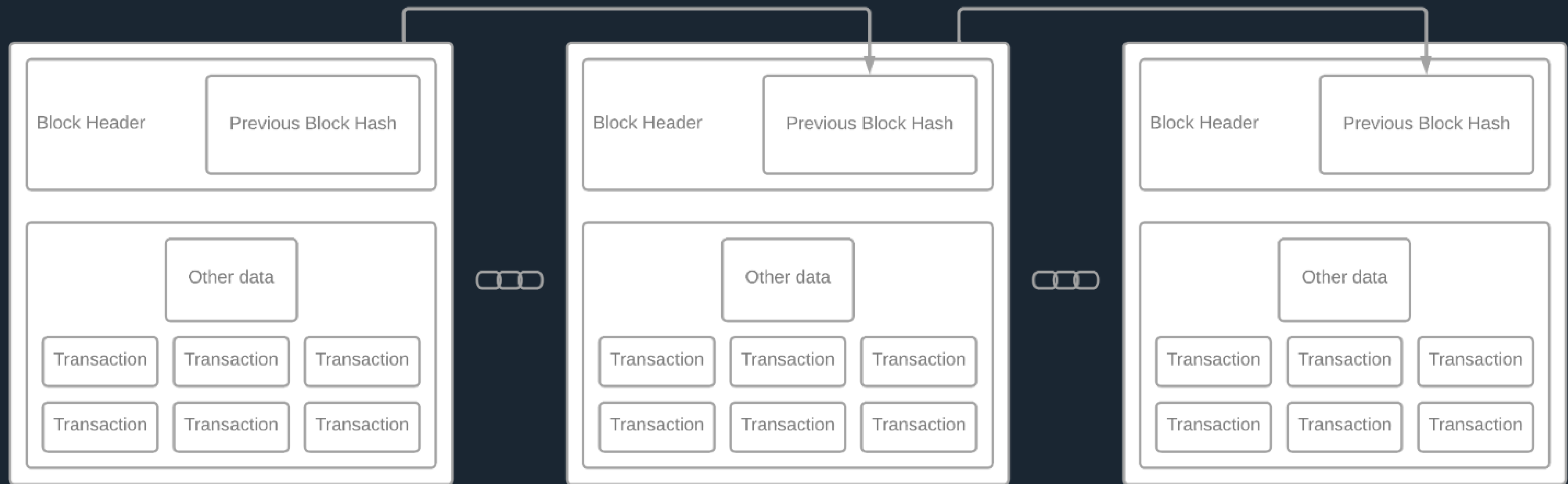


What is a block?

WHAT IS A BLOCK?

A blockchain takes the name by being a **chain of blocks**.

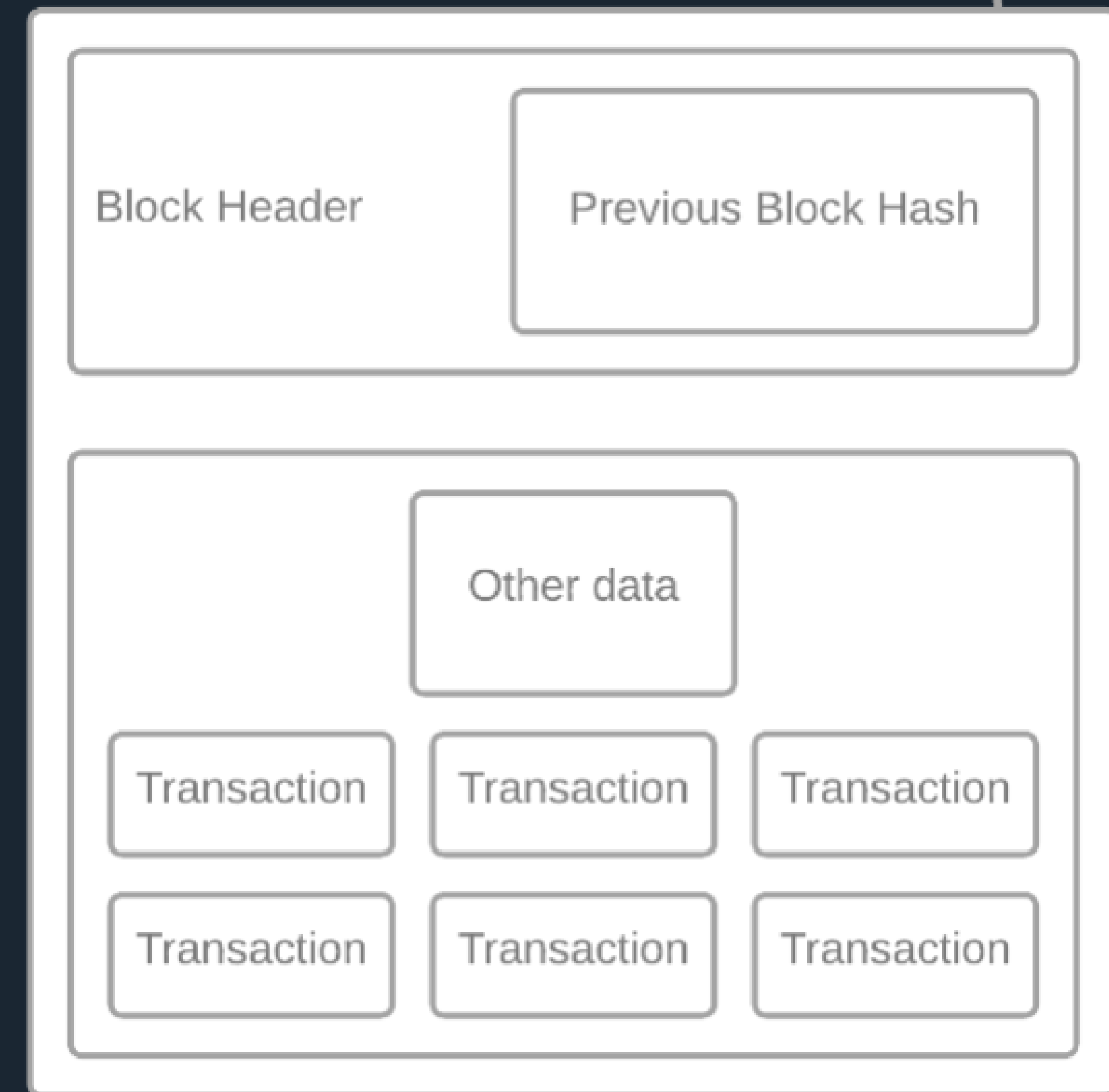
What makes it special is the fact that every block holds the **knowledge** of the previous one, this structure allows it to be very secure because not one single **PREVIOUS** block can be modified without altering the following one.



THE BLOCK IN DETAILS

We can say the block holds “the history” of the entire blockchain.

- Every block holds the hash of its own block and the hash of the previous block.
- The hash represents the block and all of its contents, if any of the contents within the block is changed, the hash value will change.
- This hash value is always unique (no other hash in the blockchain will be the same).



Characteristics

The technological advancements of Blockchain networks



BLOCKCHAIN FEATURES

Blockchain offers the following characteristics which directly enables it to provide sought after features.

- Immutability
- Transparency
- Traceability
- Security
- Decentralization

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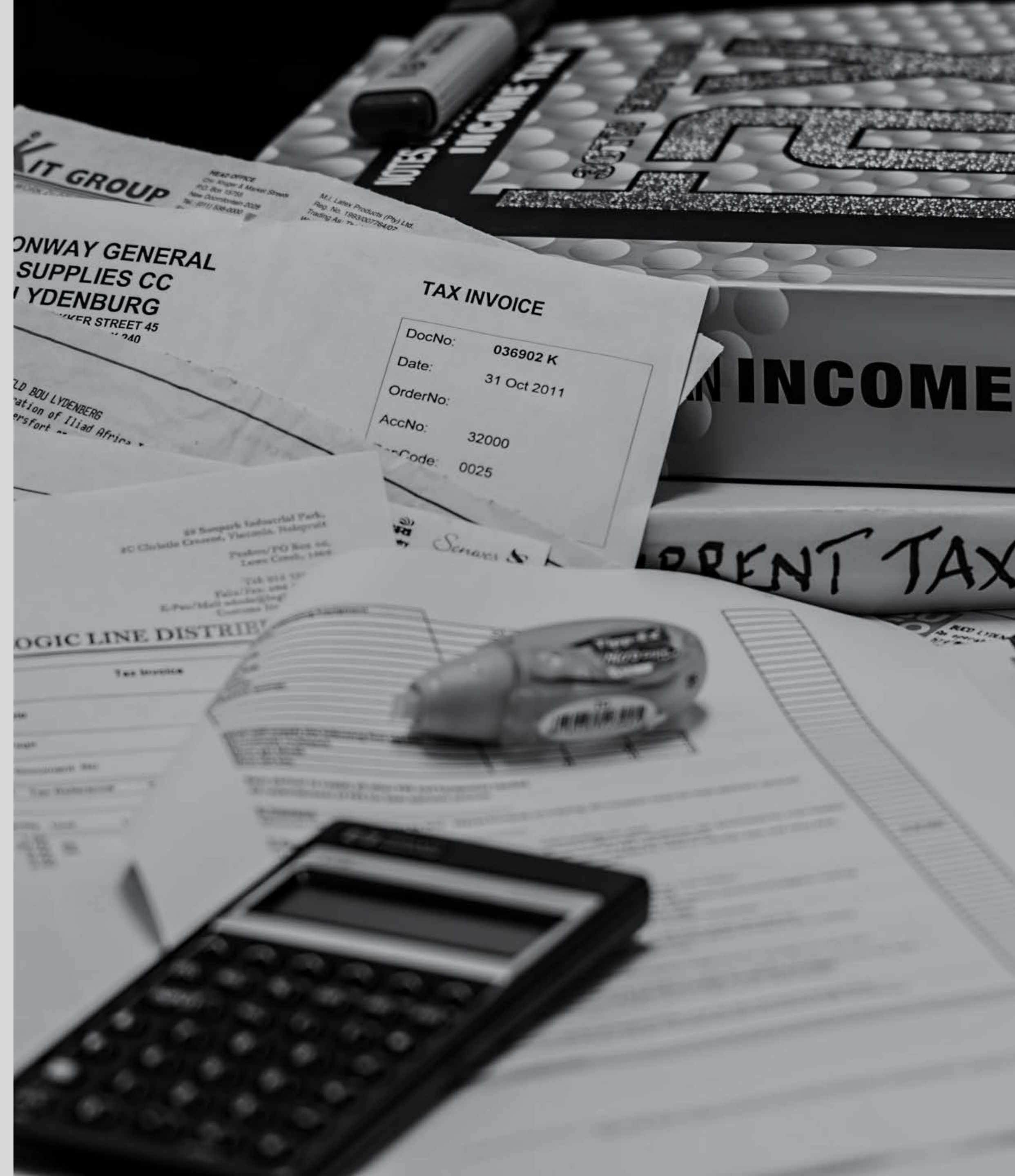


PERFECT
FOR
FINTECH

IMMUTABILITY

The ability of **temporal proof** certainty of past transactions without the fear of arguments about states is the key of any **dispute** especially in **auditing**.

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TRANSPARENCY

Every **transaction** on a blockchain is recorded and visible for anyone to see. You may not know who exactly, but you can be **certain of the what.**

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TRACEABILITY

The ability to **track every transaction** from the genesis of the blockchain until now makes it suitable for all **supply chain** applications.

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DECENTRALIZATION

The true heart of any blockchain, the ability to not be controlled by any one node. This is one of the most important, which is also the most sought after feature, as it allows for new types of businesses to exist.

No government control.

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Types of Blockchains

Different topologies for different uses.



TOPOLOGIES

Since the first inception of the Bitcoin network, Blockchain has vastly evolved with different network topology and different consensus models depending on the use case. The world of trust is a complex one, being in a distributed network where trust is enforced and everyone is anonymous may not actually be good for **business**.

Blockchain has 3 main topologies.

Public

Private

Hybrid

There is not a one solution fits all as of one, especially given that blockchain has developed into thousands of different implementations.

PUBLIC

Public blockchains are the purest implementation of the original idea.

Most public blockchains are the effort of private entities, after Bitcoin and Ethereum, there are now more than 1000 platforms.

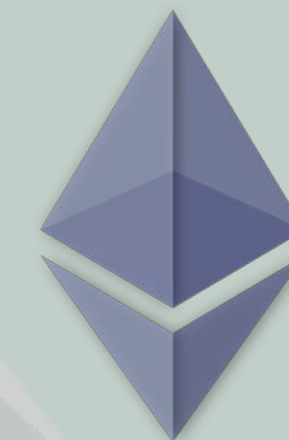
Although the public nature has created not small headaches in the community, it has also allowed for a flourishing of new technologies.

By default Blockchains cannot talk to each other, bridges are created to make this happen.

Characteristics:

- Open to join.
- Incentive-based consensus mechanism -> cryptocurrency.
- Data and transaction on chain are available to everyone.
- High decentralization.

Bitcoin, Ethereum and Algorand are examples of public blockchains



Algorand

PRIVATE

Private blockchains, also known as DLTs (Distributed Ledger Tech) are the realm of corporates and specific business.

In DLTs, there is no “hiding”, it is more of a consortium state, meaning that trust in the real world must exist. For examples, banks are well known to use DLTs for some of their services.

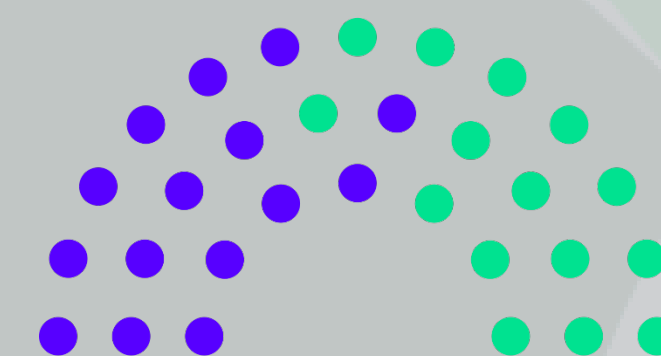
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Characteristics:

- Only invited entities can join.
- Cryptocurrency-free consensus.
- Governed by one or a group of organization(s).
- Data and transactions on chain are available to authorized participants only.

DLTs are not as straightforward, and it is sometimes complex to understand the business use cases because it is about creating complex business networks and interactions.

The most well known DLTs are Quorum and Hyperledger (IBM/Linux)



HYPERLEDGER

Time to build

The first part of the theory is over, time to start creating !



LEARN TO BUILD DAPPS

Through out this course we will build and deploy a full Dapp (decentralized app) using **Algorand**.

This Dapp will allow you to create your own NFTs out of images!

This is just the beginning; the world's problems are yours to solve!

Topics

1. **Create and fund your account with testnet funds.**
2. **Setup your development environment.**
3. **Connect account to a Dapp.**
4. **Write a simple smart contract, deploy and test.**
5. **Upload images to IPFS through a Dapp.**
6. **Create NFT on the Dapp and transfer using your wallet.**

By the end of the 6th chapter, you will have a sound understanding of how to create a Decentralized application and how to get it working in real life.

PRACTICAL JOURNEY

This is the start of the journey to build our cool Dapp.

By the end of this session, we will have **two blockchain accounts in a wallet which are funded with test cryptocurrencies.**

Topics

1. **Create and fund your account with testnet funds.**
2. **Setup your development environment.**
3. **Connect account to a Dapp.**
4. **Write a simple smart contract, deploy and test.**
5. **Upload images to IPFS through a Dapp.**
6. **Create NFT on the Dapp and transfer using your wallet.**

Practical 1

Create and fund accounts with testnet funds



BLOCKCHAIN WALLET

In this practical session, we will use **a blockchain wallet** to create some **accounts**.

Blockchain wallet is a digital wallet that **holds cryptocurrencies, tokens** and enables users to **manage them** easily.

Account is a cryptographic tool that enables users to **securely and anonymously interact** with the blockchain network.

Blockchain wallet and account will be better explained in the next session.

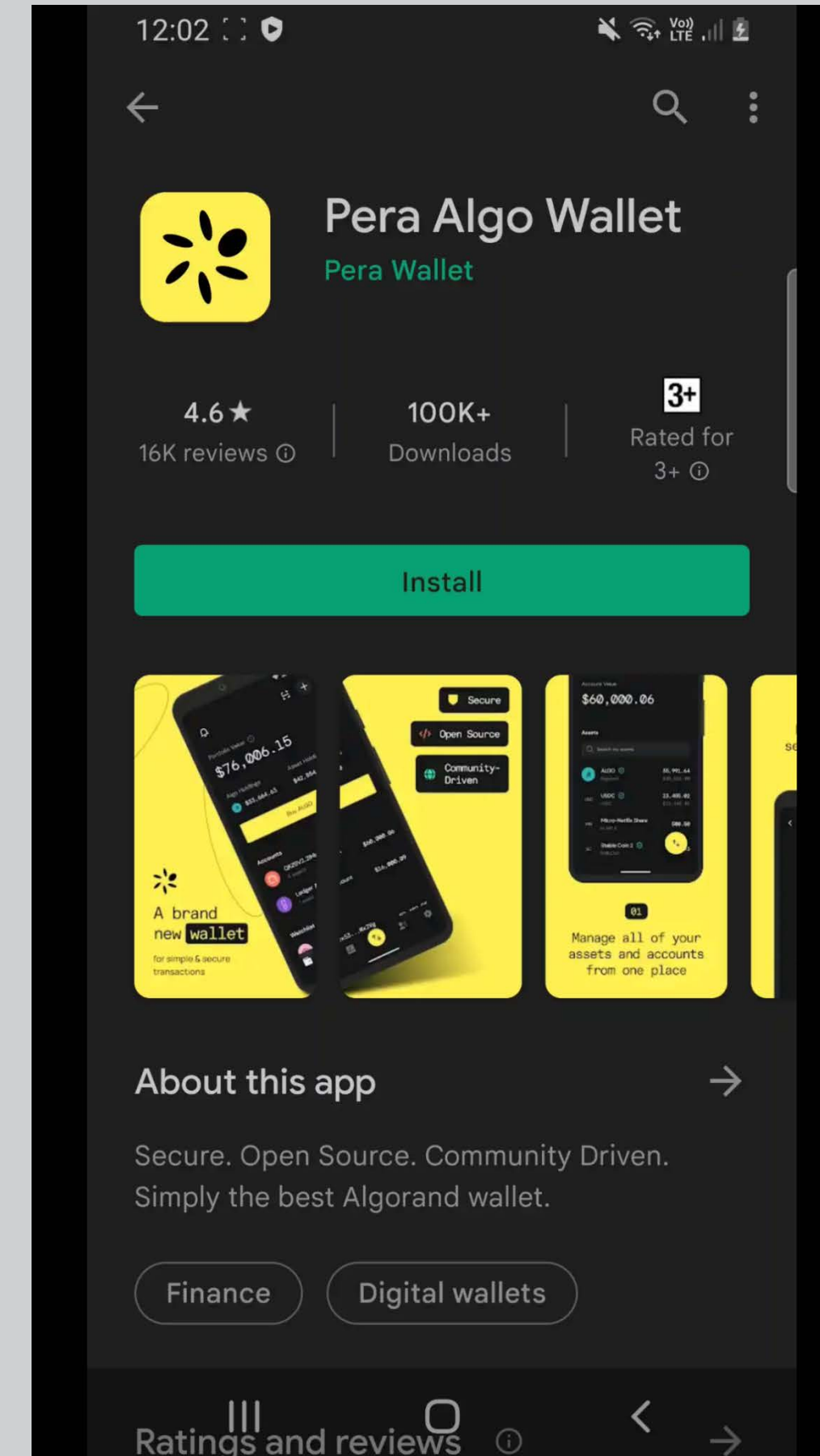


DOWNLOAD PERA ALGO WALLET

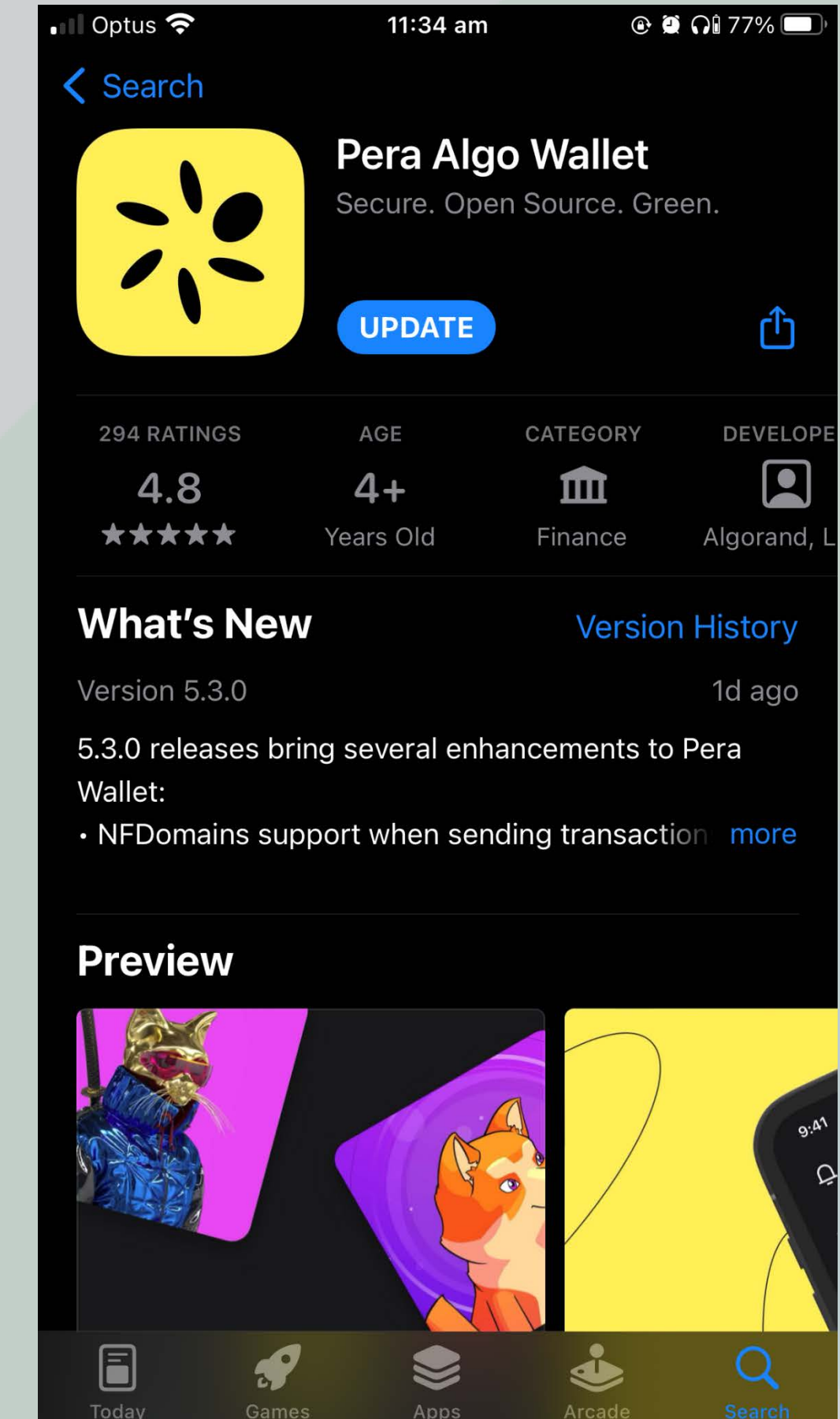
We will use a mobile wallet called **Pera Algo Wallet** to manage our accounts and hold our funds.

Let's download the app to your smartphones!

Play Store (Android)



App Store (iOS)

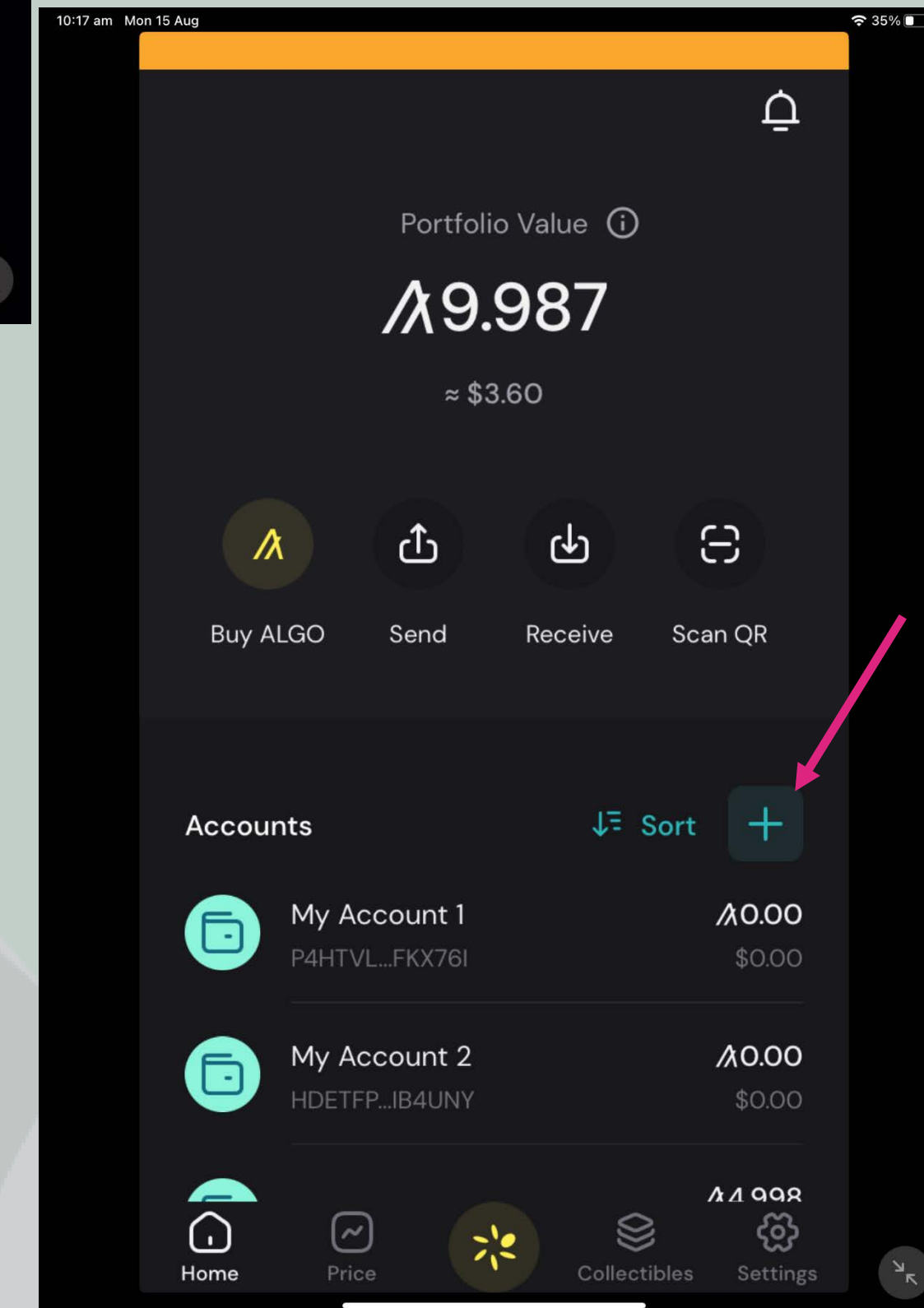
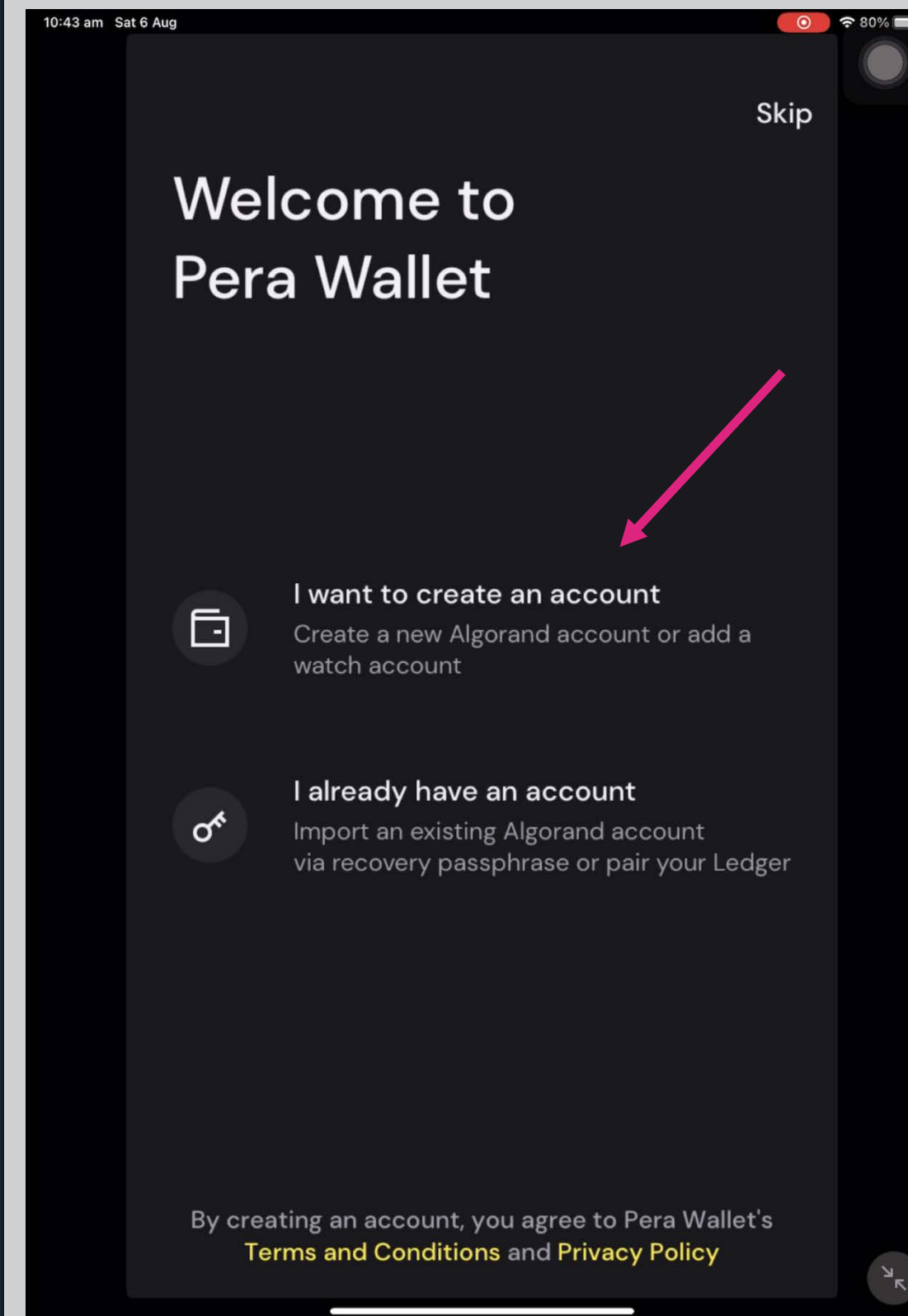


CREATE ACCOUNTS

After the app is downloaded and installed, we can go ahead and **create 2 accounts.**

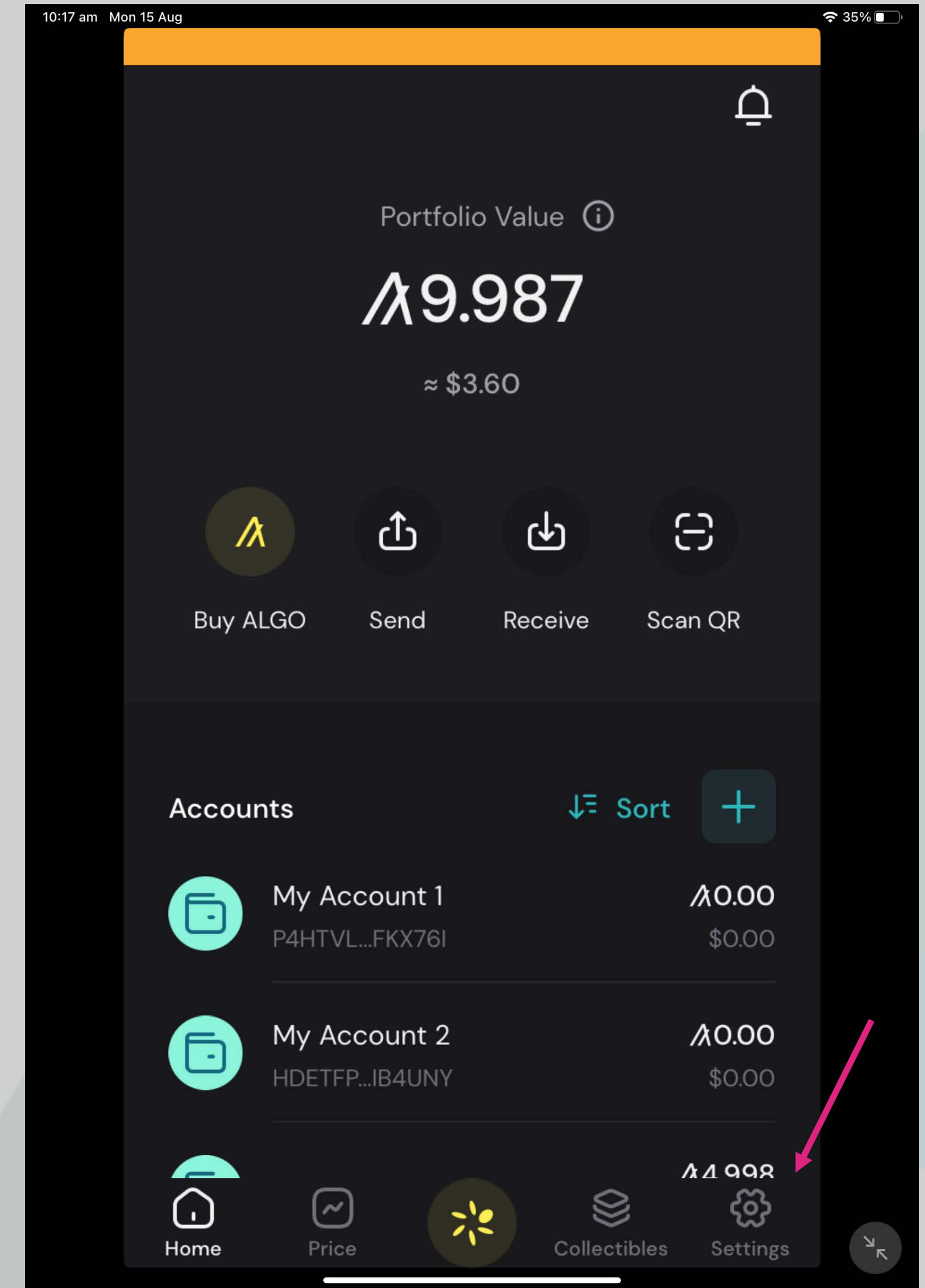
*Note: when you are asked to record the **25 mnemonic words**, make sure you write them down **in the exact provided order** (or you can just take a screenshot which is not a good practice but is quick and easy)

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CHANGE CONNECTION TO TESTNET

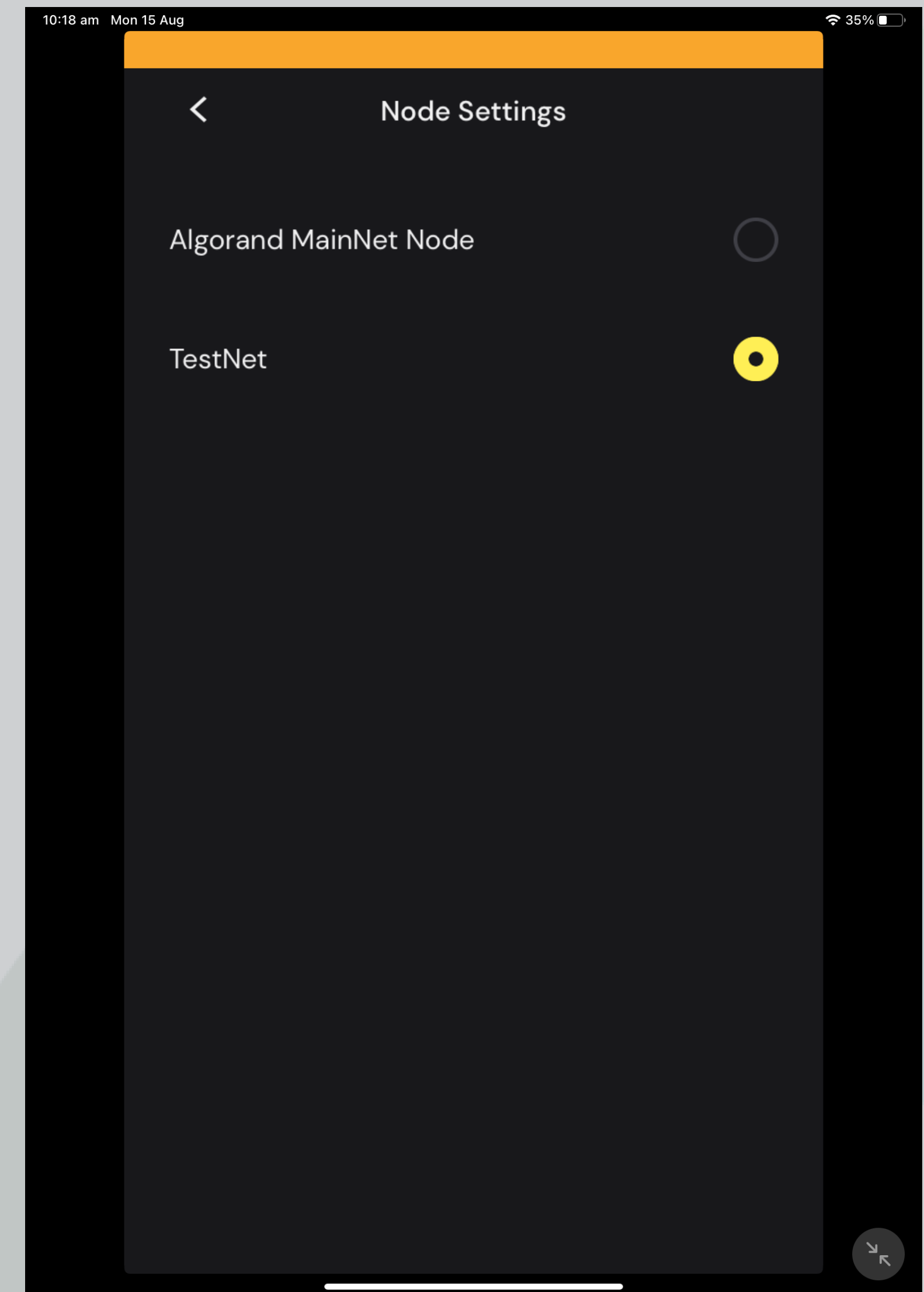
For testing purposes, we need to change wallet setting to connect to the **Algorand Testnet**. This will help avoid cost when we do testing as **cryptocurrencies on testnets are free**.



CHANGE CONNECTION TO TESTNET

From the bottom navigation menu:

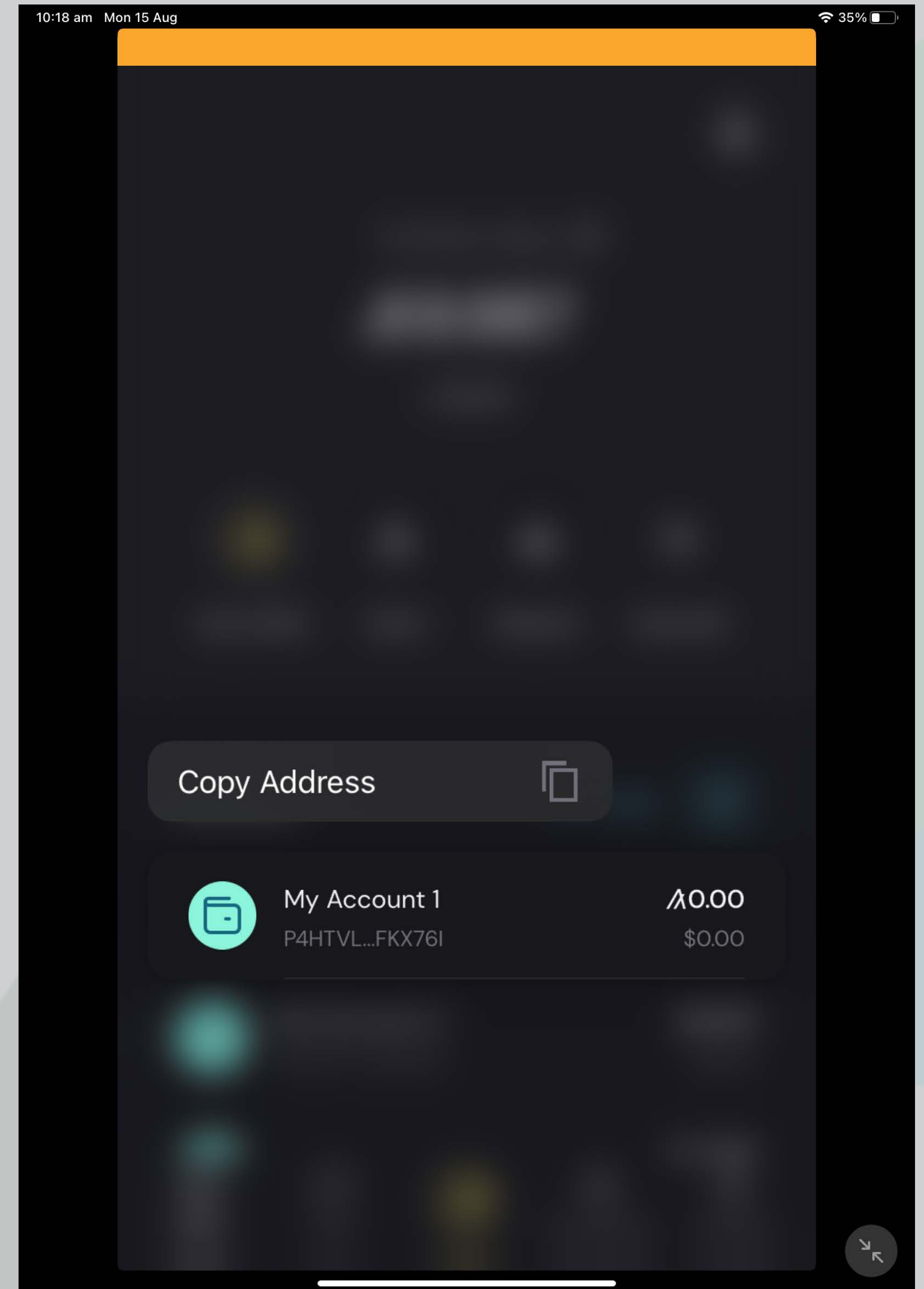
- Select “Settings”
- Select “Developer Settings”
- Select “Node Settings”
- Choose “TestNet”
- Make sure the colour of the app bar on the top changes to **orange**.



FUND ACCOUNT

Until this stage, we should have 2 accounts created. However, they do not have any ALGOs which are essential for our future testings.

So, let's fund them! We will start with copying Account 1 address by **tap and hold on Account 1** > "Copy Address"



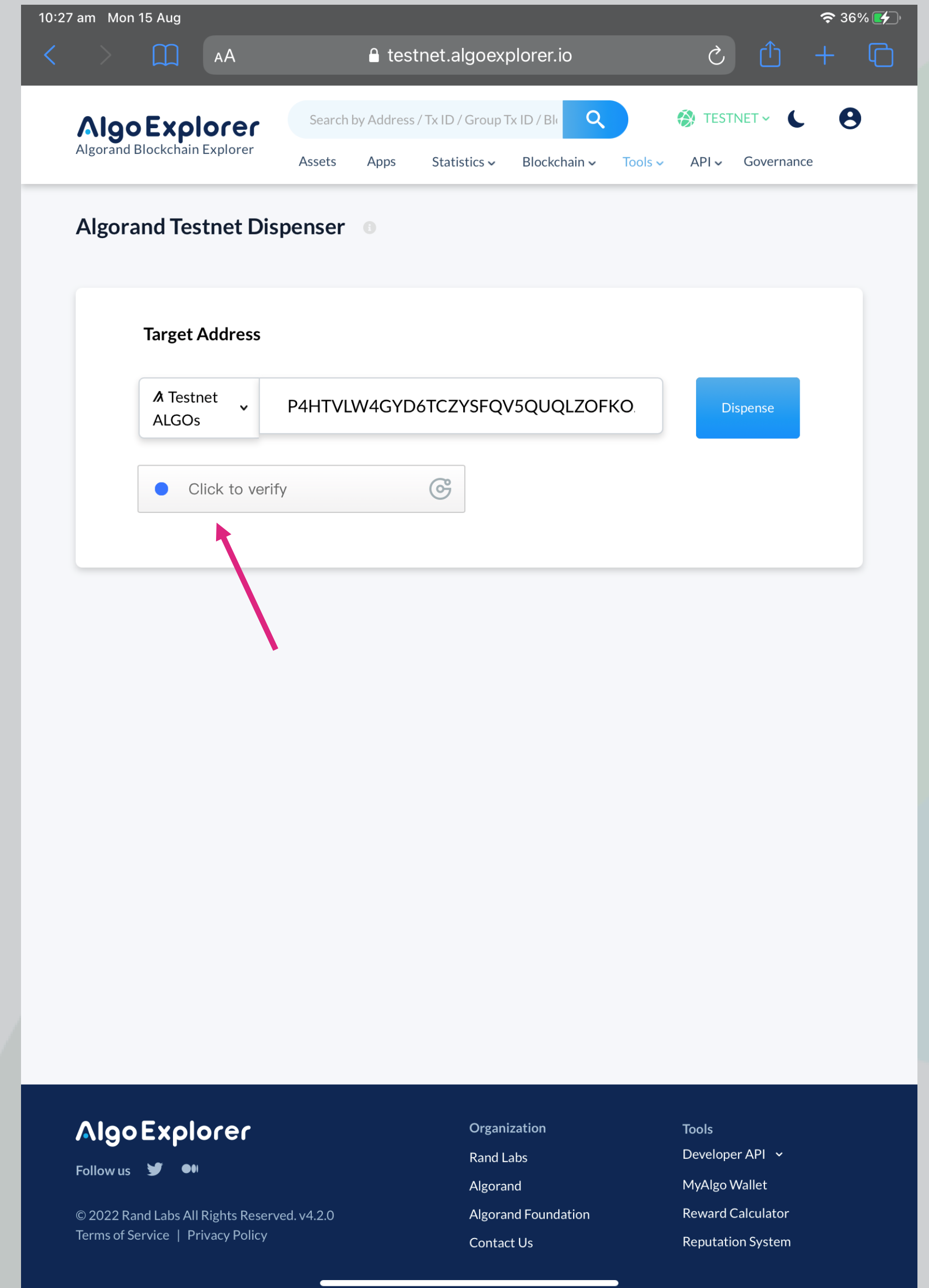
FUND ACCOUNT

Go to **Algorand Dispenser**
(<https://testnet.algoexplorer.io/dispenser>)

And paste the copied address in
the “**Target Address**” input box

Make sure you prove that you are
a human **(pink arrow)**

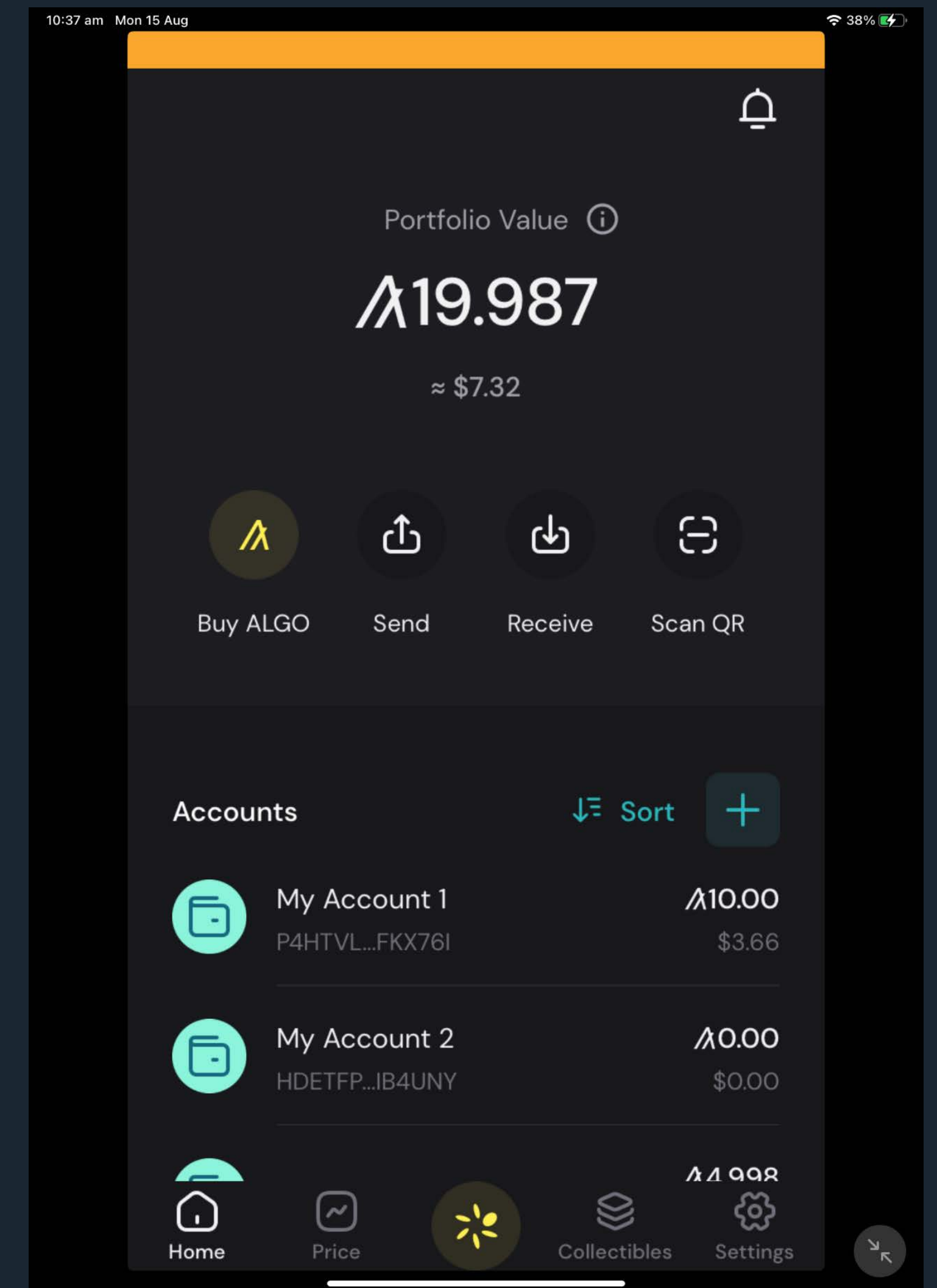
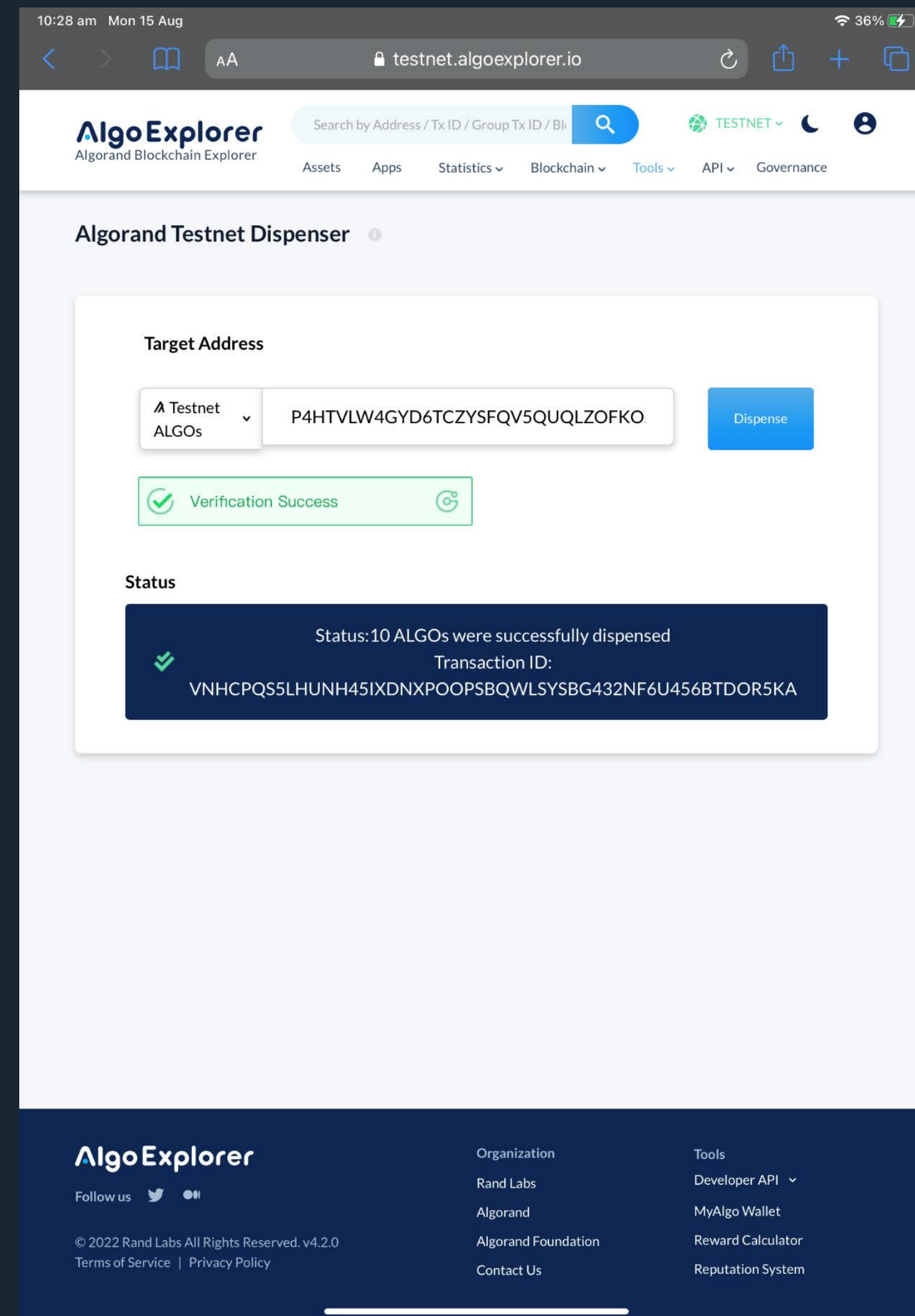
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FUND ACCOUNT

Click “**Dispense**”.
Successful
transaction will send
10 ALGOs to the
target account (left
photo).

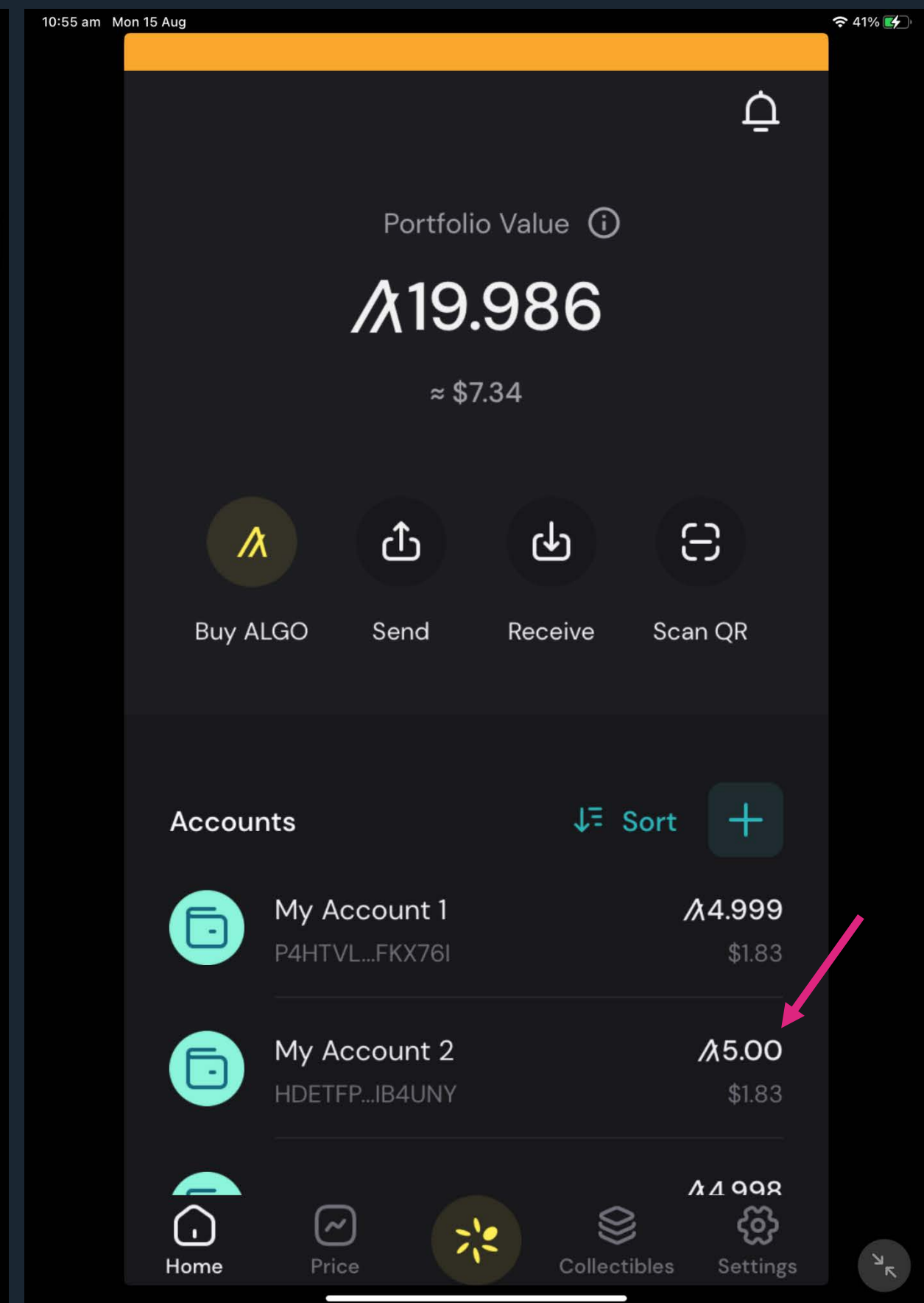
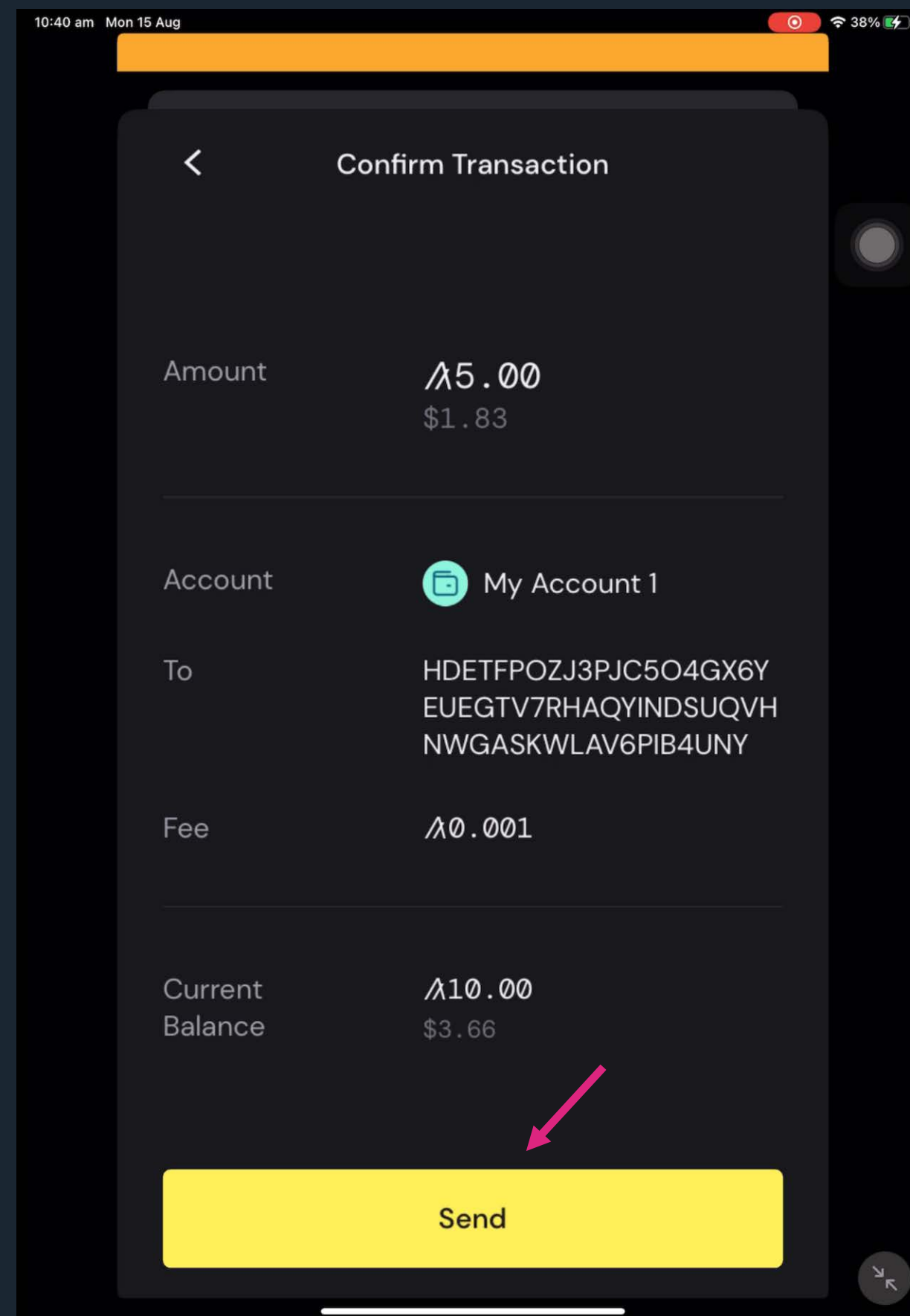
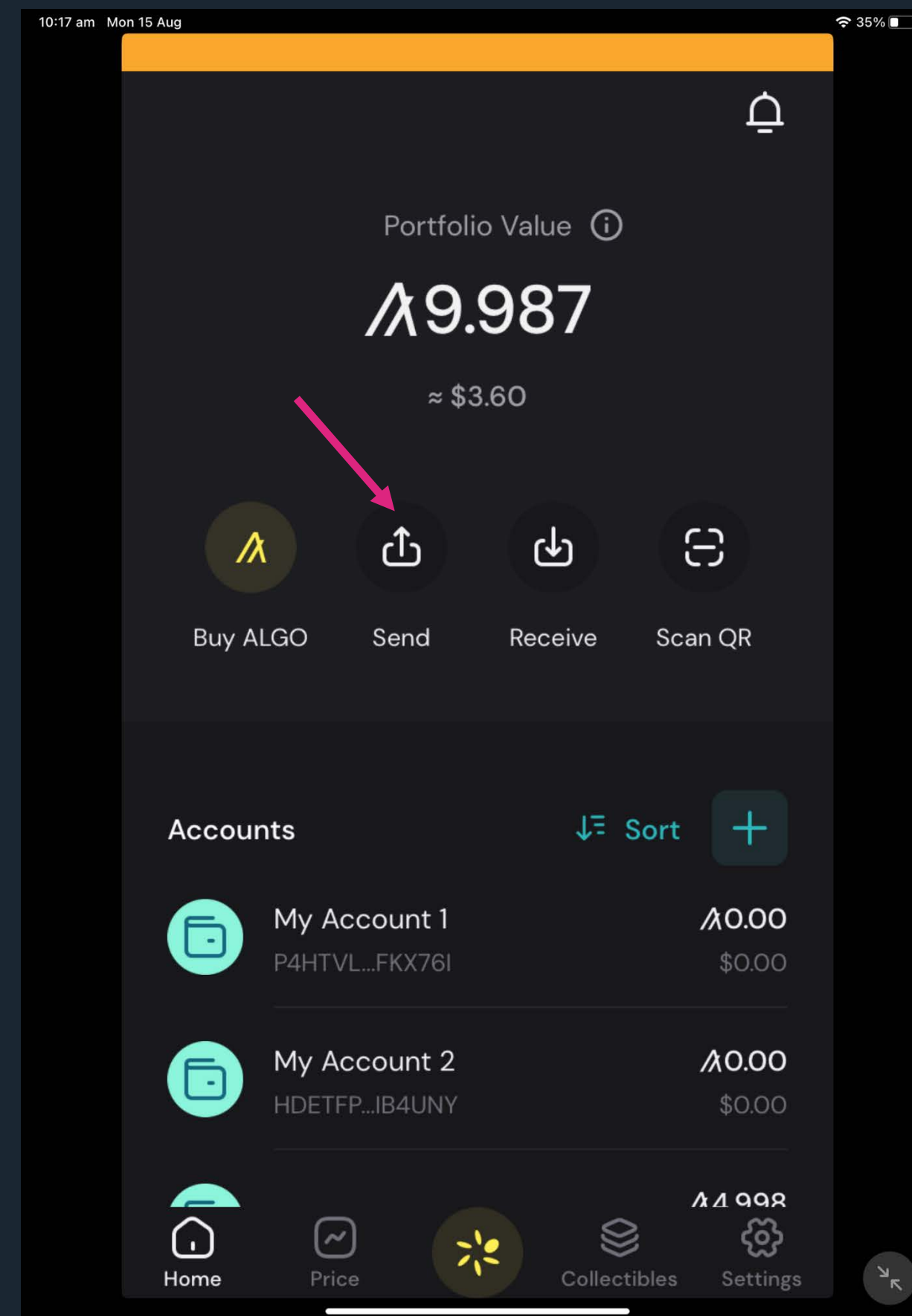
After a moment,
your wallet will be
updated with the
funded amount (right
photo)



SEND ALGOS

The Account 2 also needs to be funded. So, we will **send 5 ALGOs from Account 1** to it:

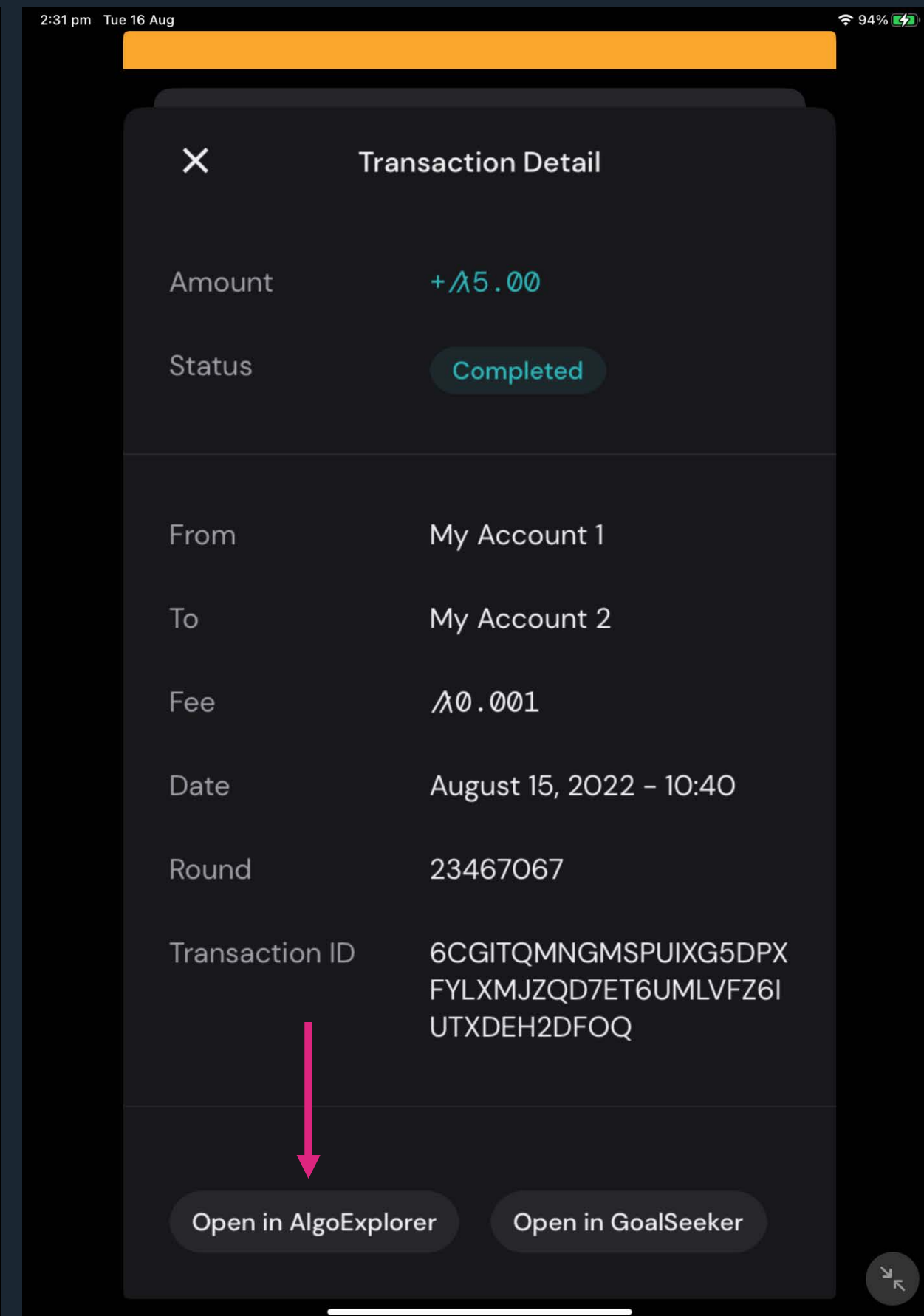
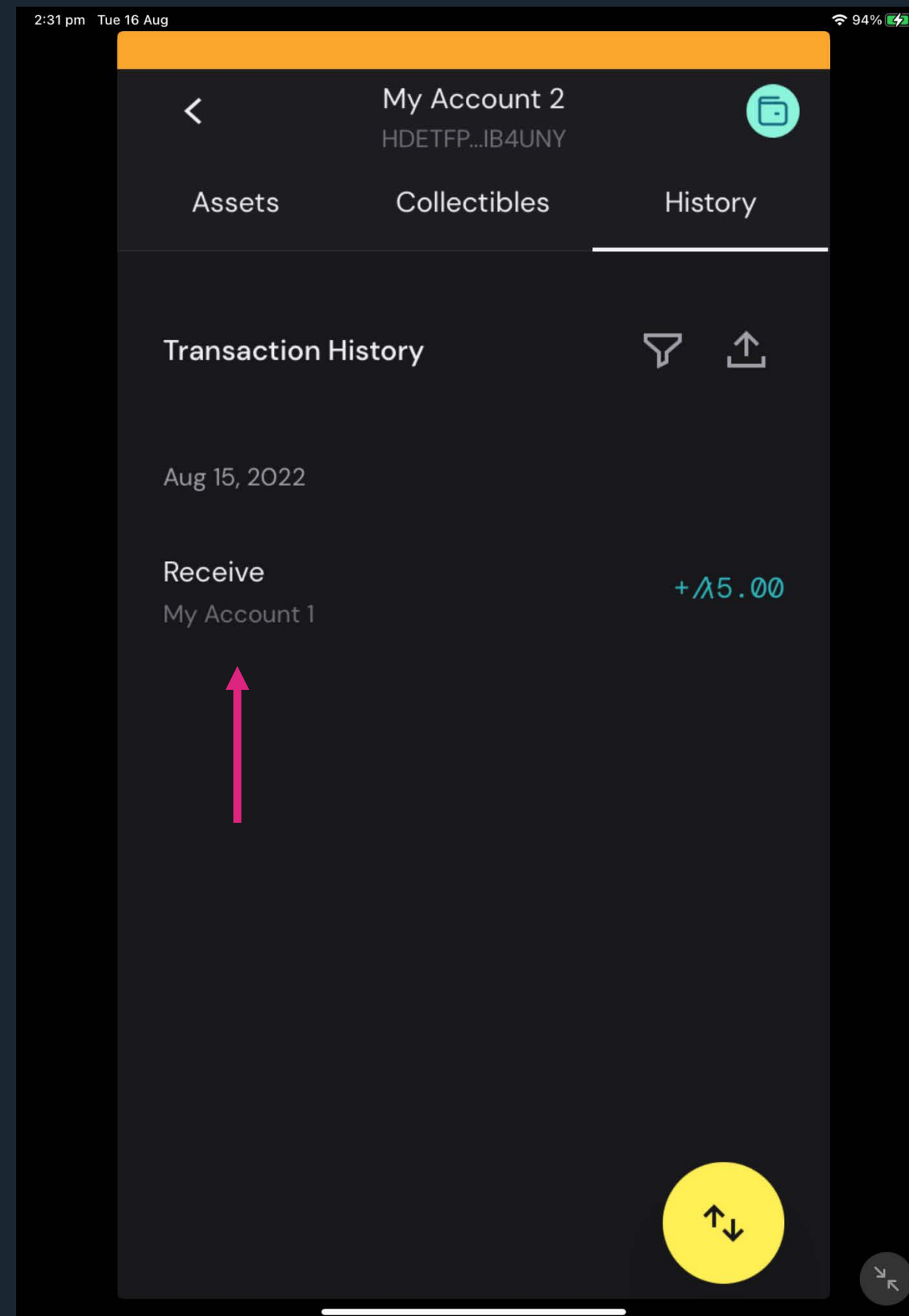
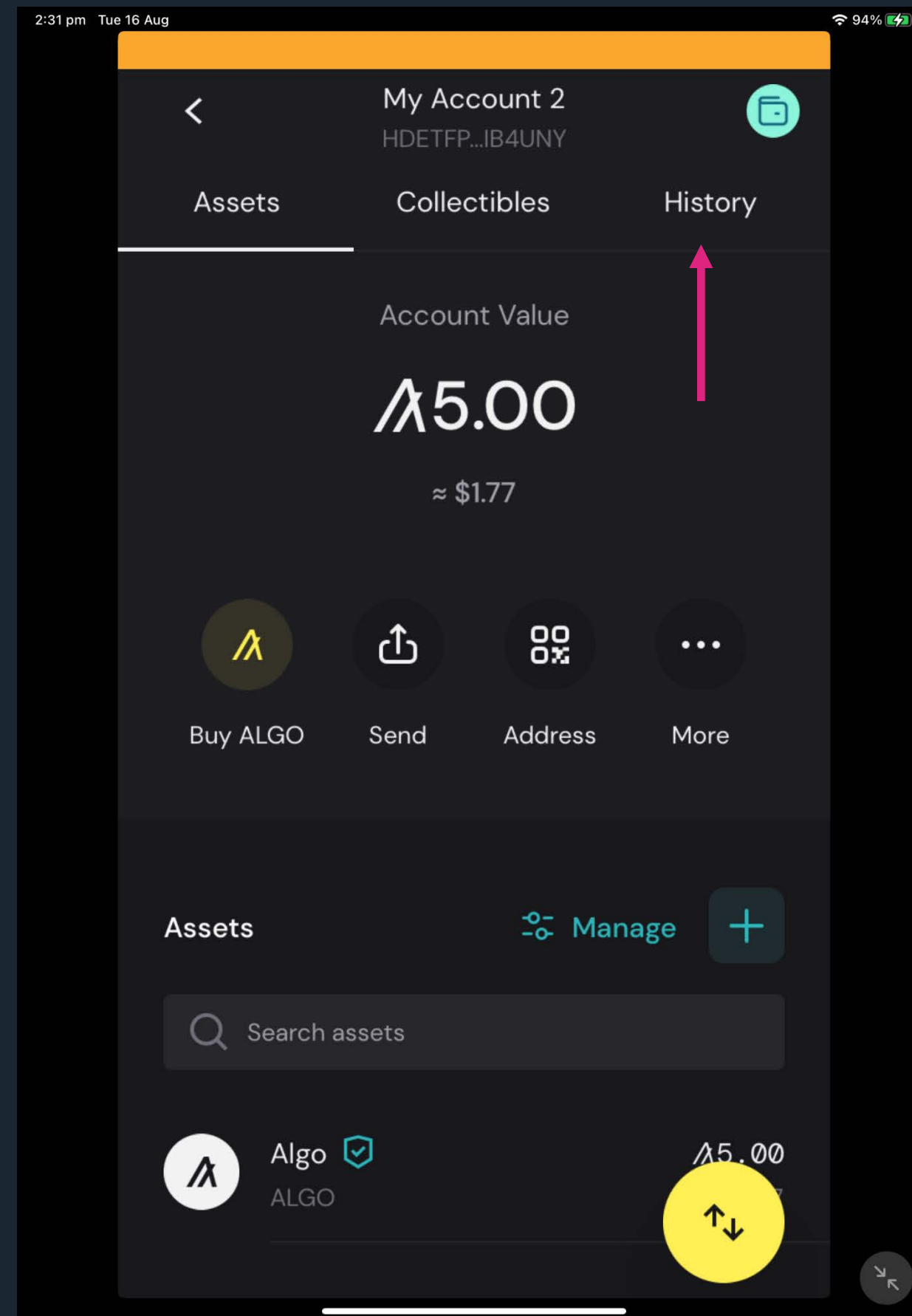
- “Send”
- “Account 1
- “Algo”
- Enter 5 > “Next”
- “Account 2”
- “Send”.



TRANSACTION DETAILS

After the transaction is successfully executed, we can check it on **AlgoExplorer**:

- Select either “**Account 1**” or “**Account 2**”
- Tap on “**History**” tab
- Select the **transaction with 5 ALGOs**.
- Select “**Open in AlgoExplorer**” at the bottom.



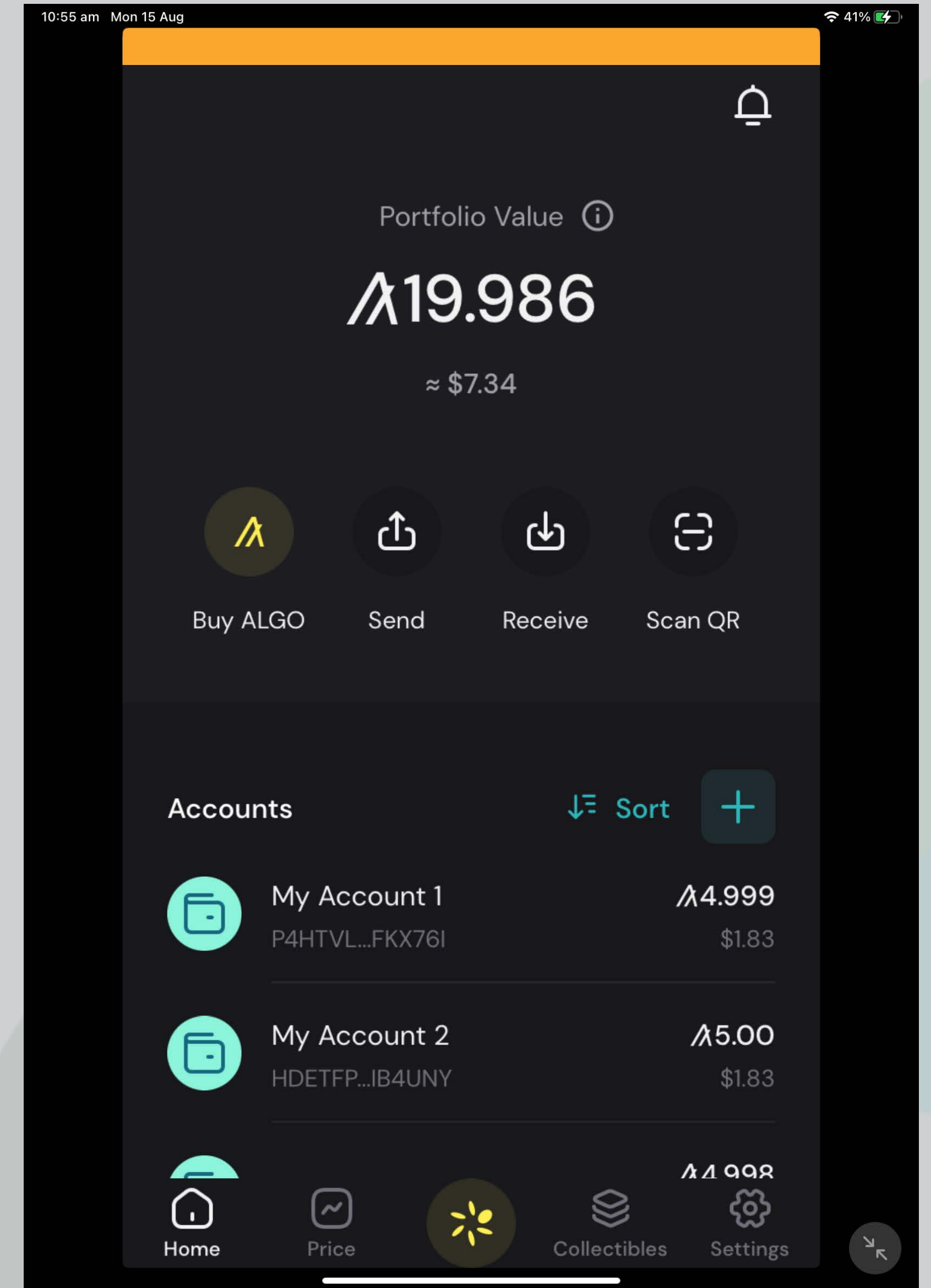
TRANSACTION DETAILS

Details about the transaction are available to be retrieved.

The screenshot displays the 'Algo Explorer' mobile application interface. At the top, the status bar shows the time as 10:41 am on Monday, August 15, with a 38% battery level. The app's header includes the URL 'testnet.algoexplorer.io' and the 'Algo Explorer' logo with the subtitle 'Algorand Blockchain Explorer'. A search bar is positioned below the header, containing the text 'Search by Address / Tx ID / Group Tx ID / Block' and a magnifying glass icon. The main content area is titled 'Transaction Details' and features three rows of information: 'Sender: P4HTVLW4GYD6TCZY...' with a copy icon, 'Amount: 5', and 'Receiver: HDETFPOZJ3PJC5O4G...' with a copy icon. Below this, a section titled 'More Information' is expanded, showing four data points in a grid: 'First Round' with the value '23467063', 'Sender Balance' with '⌘ 4.999', 'Receiver Balance' with '⌘ 5', and 'Fee' with '⌘ 0.001'. The app's bottom navigation bar is partially visible at the bottom right.

FUNDED ACCOUNTS

Finally, we have **2 funded accounts** which are super useful for the coming practical sessions.



We have done our first practical session where we learn how to create accounts in Pera Algo Wallet, fund them with test ALGOs and transfer test ALGOs from one account to another.

In the next practical session, we will setup a development environment with the Algorand sandbox.