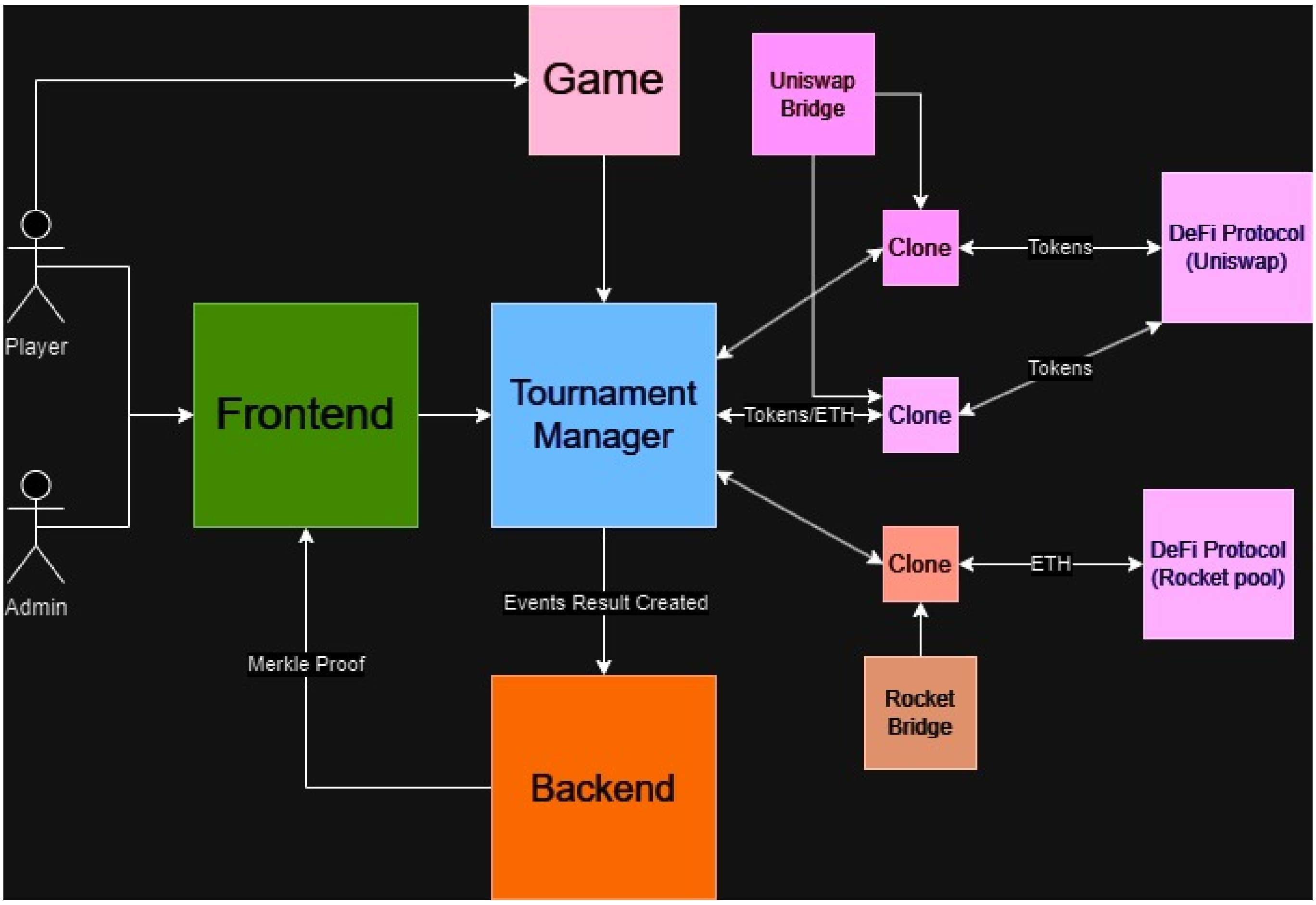
Blockchain Tournaments FMP Project

Welcome to the Blockchain Tournaments FMP (Final Master's Project) Project! This project represents the culmination of the Blockchain Technologies Master's Degree at the UPC Tech School.

Overview

The Blockchain Tournaments FMP Project is a decentralized application (DApp) built using Solidity and web technologies. It is designed for creating and managing blockchain-based tournaments where participants can enroll by paying an entry fee. These tournaments accept various ERC20 tokens, which are then invested in different DeFi (Decentralized Finance) protocols to generate interest. The interest generated serves as the prize pool for tournament winners. This project prioritizes trustless operations and has been implemented with modularity in mind.



Technologies

The technologies used by this project:

- **Web**
  - Next.js
  - TailwindCSS
  - TypeScript
  - Scaffold
  - Vercel

- **Blockchain**
  - Solidity
  - Hardhat
  - Goerli

Project Structure

The project consists of the following components:

- **Smart Contracts**: The Ethereum smart contracts, written in Solidity, are responsible for managing tournaments, investments, and user interactions. Here are the main contract components:

  - **TournamentManager**: Main contract of the project, governs all tournaments, facilitates the collection of tokens, and enables tournament participants to claim their rewards.
  - **DeFi bridges**: Pre-deployed implementation smart contracts containing the logic to link our tournament manager with one accepted DeFi protocol.
  - **Clones**: These are OpenZeppelin Minimal Proxies that are used to connect to the DeFi Bridges and manage investments separately for each tournament.
  - **MajorHashGame**: A sample game created for explanatory purposes, illustrating the project's workflow.

- **Frontend**: The user interface, developed using web technologies such as React.js, allows users to interact with the smart contracts and provides an intuitive user experience. The frontend includes the following key views:

  - **Create Tournament**: Admin users can create an unlimited number of tournaments.
  - **Tournaments**: This view displays all available tournaments and allows users to enroll, play, and claim their tournament rewards. The frontend fetches data directly from the blockchain, ensuring transparency and real-time updates.

- **Backdend**: The backend component recreates the on-chain Merkle tree and manages other essential functions of the project.

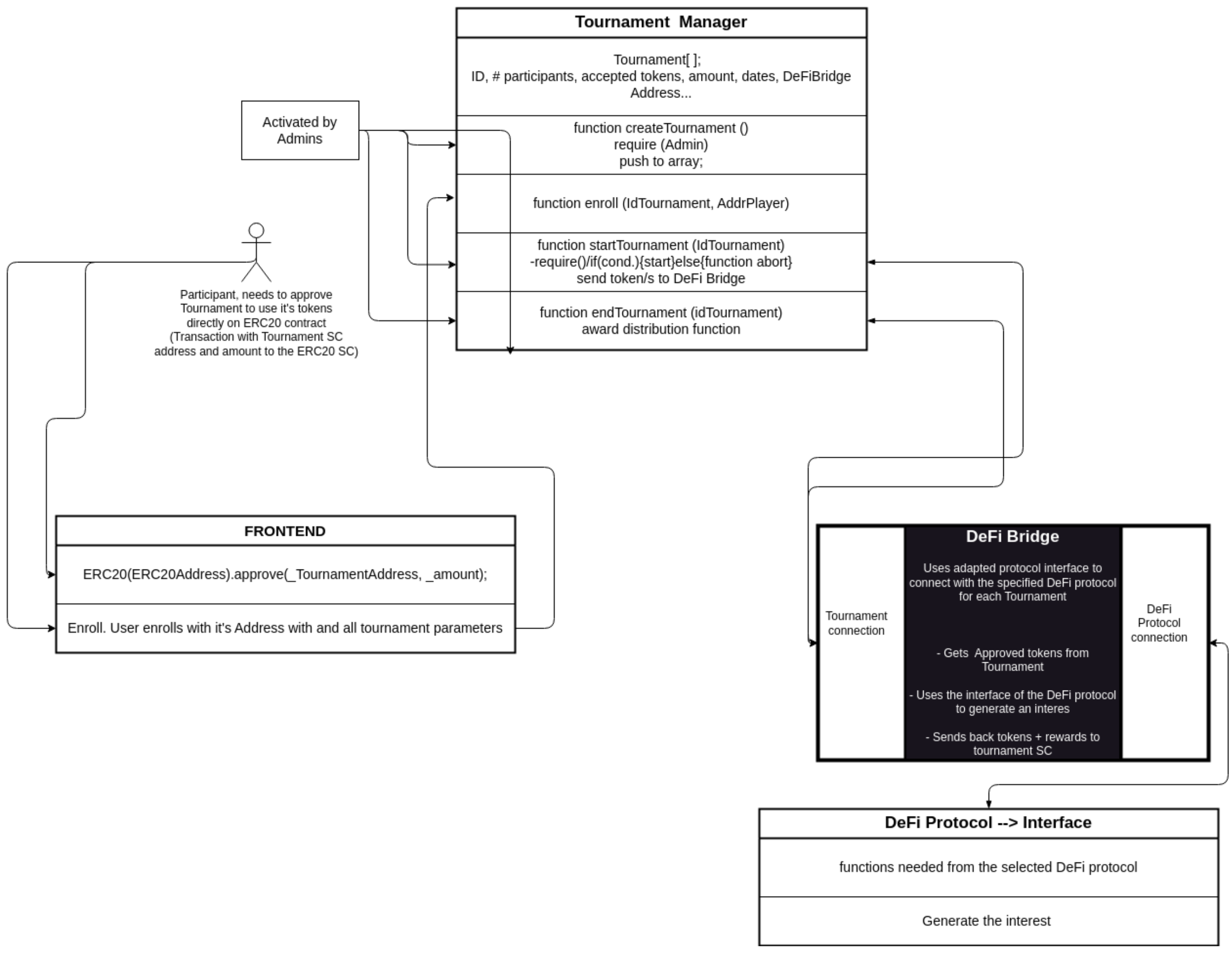
How It Works

- **Tournament Creation**: Admins can create new tournaments by specifying parameters like maximum and minimum participants, entry fees, acceptable ERC20 tokens, and more. During the tournament's creation, a contract clone pointing to a "DeFi Bridge Smart Contract" is deployed. This clone manages the interaction with the DeFi protocol, providing two significant features. First, it allows for the independent management of investments for each tournament, and second, it enables the deployment of new DeFi Bridges to interact with other DeFi protocols.

- **Tournament Enrollment**: Participants can enroll in tournaments by paying the specified entry fee and meeting the tournament's criteria. A detailed explanation of the used protocols and investment timings will be provided.

- **Tournament Start**: When the enrollment period has finished, all the collected tokens are invested in the pre-set DeFi protocol.

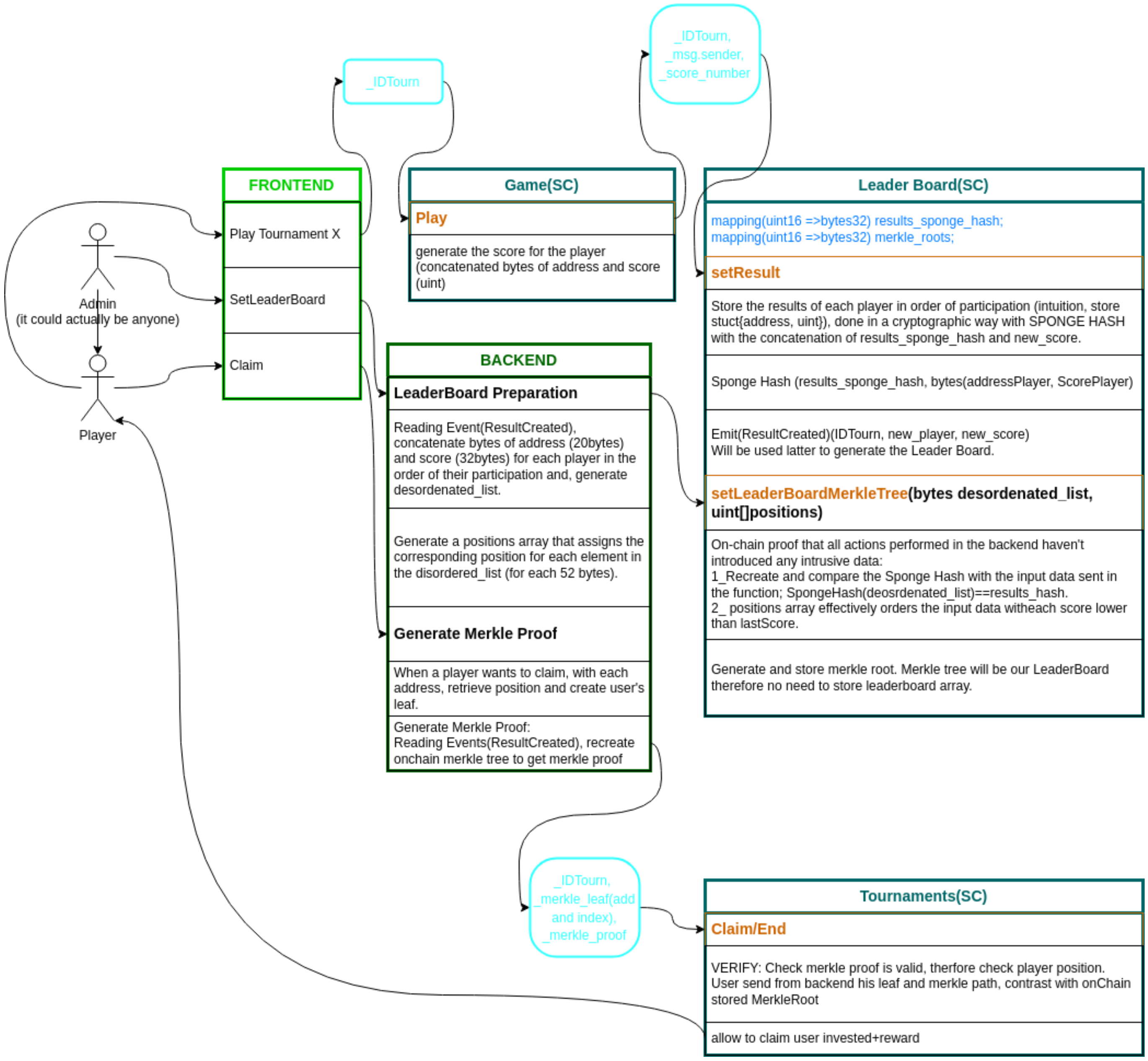
- **DeFi Investment**: The project integrates with DeFi protocols to invest the funds collected from participants. This investment generates interest, which forms the tournament's prize pool.


Tournament Manager
Tournament[ ];
ID, # participants, accepted tokens, amount, dates, DeFiBridge Address...
function createTournament ()
require (Admin)
push to array;
function enroll (IdTournament, AddrPlayer)
function startTournament (IdTournament)
-require()/if(cond.){start}else{function abort}
send token/s to DeFi Bridge
function endTournament (idTournament)
award distribution function
Activated by Admins
Participant, needs to approve Tournament to use it's tokens directly on ERC20 contract (Transaction with Tournament SC address and amount to the ERC20 SC)
FRONTEND
ERC20(ERC20Address).approve(_TournamentAddress, _amount);
Enroll. User enrolls with it's Address with and all tournament parameters
DeFi Bridge
Uses adapted protocol interface to connect with the specified DeFi protocol for each Tournament
- Gets Approved tokens from Tournament
- Uses the interface of the DeFi protocol to generate an interes
- Sends back tokens + rewards to tournament SC
Tournament connection
DeFi Protocol connection
DeFi Protocol --> Interface
functions needed from the selected DeFi protocol
Generate the interest

- **Tournament Play**: The game of the tournament could be either off-chain or on-chain. The project is designed to demonstrate and validate the classification by setting the game results for each player (just one play per player). Each accepted game should provide the player's address and a score, with the largest score determining the tournament winner. A hash of every result (address + score) is generated and hashed with the previous results to create and store a unique cryptographic summary of the tournament, which we called SpongeHash.

- **Tournament End**: When the end date arrives, the invested tokens are withdrawn, along with the rewards generated during the stake period. These are then sent to the main contract to enable users to claim their rewards. With all the results taken from the events a merkle root ordenated with the tournament clasification order would be stored. The input data will be verified by recreating the stored SpongeHash.

- **Claim**: Using the player's address, their position will be retrieved from the backend, and a merkle proof will be generated for the player to claim their reward. The claim will be enabled when the merkle proof is verified on-chain.


_IDTourn
_IDTourn, _msg.sender, _score_number
FRONTEND
Play Tournament X
SetLeaderBoard
Claim
Admin
(it could actually be anyone)
Player
Game(SC)
Play
Leader Board(SC)
setResult
BACKEND
LeaderBoard Preparation
Generate Merkle Proof
setLeaderBoardMerkleTree(bytes desordenated_list, uint[]positions)
_IDTourn, _merkle_leaf(add and index), _merkle_proof
Tournaments(SC)
Claim/End

generate the score for the player (concatenated bytes of address and score (uint)

mapping(uint16 =>bytes32) results_sponge_hash;
mapping(uint16 =>bytes32) merkle_roots;

Store the results of each player in order of participation (intuition, store stuct{address, uint}), done in a cryptographic way with SPONGE HASH with the concatenation of results_sponge_hash and new_score.

Sponge Hash (results_sponge_hash, bytes(addressPlayer, ScorePlayer)

Emit(ResultCreated)(IDTourn, new_player, new_score)
Will be used latter to generate the Leader Board.

Reading Event(ResultCreated), concatenate bytes of address (20bytes) and score (32bytes) for each player in the order of their participation and, generate desordenated_list.

Generate a positions array that assigns the corresponding position for each element in the disordered_list (for each 52 bytes).

When a player wants to claim, with each address, retrieve position and create user's leaf.

Generate Merkle Proof:
Reading Events(ResultCreated), recreate onchain merkle tree to get merkle proof

On-chain proof that all actions performed in the backend haven't introduced any intrusive data:
1_Recreate and compare the Sponge Hash with the input data sent in the function; SpongeHash(deosrdenated_list)==results_hash.
2_ positions array effectively orders the input data witheach score lower than lastScore.

Generate and store merkle root. Merkle tree will be our LeaderBoard therefore no need to store leaderboard array.

VERIFY: Check merkle proof is valid, therfore check player position. User send from backend his leaf and merkle path, contrast with onChain stored MerkleRoot

allow to claim user invested+reward

Demo

LINK

Getting Started

To get started with the Blockchain Tournaments FMP Project, follow these steps:

1. **Clone the Repository**: Clone this GitHub repository to your local machine.

```
git clone https://github.com/TFM-Torneos-Blockchain/scaffoldVersion
```

2. **Install Dependencies**: Navigate to the project directory and install the necessary dependencies for both the smart contracts and frontend.

```
yarn install
```

3. **Compile and Deploy**: Compile the smart contracts and deploy them to your preferred Ethereum testnet or network.

4. **Start the Frontend**: Run the frontend application to interact with the smart contracts.

```
yarn start
```

5. **Run hardhat and deploy contracts**: Run the hardhat network and deploy the smart contracts.

```
yarn chain
yarn deploy
```

Contributors

This project welcomes contributions from the open-source community. If you'd like to contribute, please fork the repository, make your changes, and submit a pull request.

License

The Blockchain Tournaments FMP Project is open-source software licensed under the MIT License.

Thank you for your interest in the Blockchain Tournaments FMP Project. We hope you find it both educational and useful for your blockchain journey!