# High Level Design (HLD):

## Project Title:

**Cryptocurrency Liquidity Prediction for Market Stability**

## Project Goal:

The goal of this project is to predict the liquidity ratio of cryptocurrencies based on features such as price, 24-Hour trading volume, market capitalization, and volatility. This helps in understanding how easily cryptocurrencies can be bought or sold, thereby contributing to market stability.

## Overview:

- **Data Collection:**
  Collected data from **CoinGecko** on two specific dates: March 16 and March 17, 2022.

- **Data Cleaning:**
  Removed missing values and duplicates to ensure data quality.

- **Feature Engineering:**
  Created new features such as:
  - ➢ 2-day moving averages
  - ➢ Volatility
  - ➢ Liquidity Ratio

- **Exploratory Data Analysis (EDA):**
  - ➢ Analyzed trends and patterns in the data
  - ➢ Generated visualization like price plots and correlation heatmaps
  - ➢ Summarized key statistics to understand feature distributions

- **Model Building:**
  - ➢ Linear Regression (Used as a basic model for baseline comparison)
  - ➢ Random Forest Regressor (Used as the final model with hyperparameter tuning)

- **Model Evaluation:**
  Using metrics like RMSE, MAE, and $R^2$ score

- **Model Deployment & Testing:**
  - ➢ Model saved using **Joblib**
  - ➢ Built an interactive web app using **Streamlit**
  - ➢ Deployed locally using **ngrok**
  - ➢ Successfully tested with **custom user inputs** to generate predictions

## Major Components

1. **Data Ingestion:**
   - Loading CSV files into Pandas DataFrames.

2. **Data Cleaning:**
   - Handling missing value
   - Duplicate removal
   - Data type conversion

3. **Feature Engineering:**
   - Created new columns:
     Price_ma_2, mkt_cap_ma_2, volatility, liquidity_ratio

4. **EDA:**
   - Plotting Bitcoin price over time
   - Correlation heatmap
   - Summary Statistics

5. **Model Training and Tuning:**
   - Linear Regression (Baseline)

- Random Forest Regressor with hyperparameter tuning

6. **Model Evaluation:**
   - Evaluation Metrics: RMSE, MAE, $R^2$ score

7. **Model Saving:**
   - Saved using Joblib as liquidity_prediction_model.pkl

8. **Deployment:**
   - Streamlit app created for UI
   - Ngrok used for local testing
   - Verified prediction with user-defined inputs

## Tools and Technologies:

- Python
- Pandas, NumPy
- Matplotlib, Seaborn
- Scikit-learn
- Joblib
- Streamlit / Flask for local deployment (Optional)

# High level Design (HLD) Diagram for cryptocurrency liquidity prediction project