

# High Level Design (HLD)

## Project Title:

**Cryptocurrency Liquidity Prediction for Market Stability**

## Objective:

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

## Overview:

The project involves:

- Data collection from two CoinGecko datasets (March 16 and March 17, 2022).
- Data cleaning by removing missing values and duplicates.
- Feature engineering: Creating moving averages, volatility, and liquidity ratio features.
- Exploratory Data Analysis (EDA): Understanding trends and relationships between variables.
- Model building:
  - Linear Regression (basic model)
  - Random Forest Regressor (final model after hyperparameter tuning)
- Model evaluation: Using metrics like RMSE, MAE, and  $R^2$  Score.
- Saving the best model for future predictions.

## Major Components:

1. **Data Ingestion:** Loading CSV files into Pandas DataFrames.
2. **Data Cleaning:** Handling missing values, duplicate removal, data type conversion.

3. **Feature Engineering:** Creation of new columns like `price_ma_2`, `mkt_cap_ma_2`, `volatility`, and `liquidity_ratio`.
4. **EDA:**
  - Plotting Bitcoin price over time.
  - Correlation heatmap between numeric features.
  - Summary statistics.
5. **Model Training and Tuning:**
  - Initial training with Linear Regression.
  - Hyperparameter tuning and training Random Forest Regressor.
6. **Model Evaluation:**
  - RMSE, MAE,  $R^2$  Score calculated.
7. **Model Saving:** Final model saved as `liquidity_prediction_model.pkl` using Joblib.
8. **Deployment (optional):** A simple Streamlit app for local testing.

## Tools and Technologies:

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

## High Level Design (HLD) Diagram for Cryptocurrency Liquidity Prediction Project

