Eggstrain

Authors: Connor, Kyle, Sarvesh

Vectorized Push-Based inspired Execution Engine

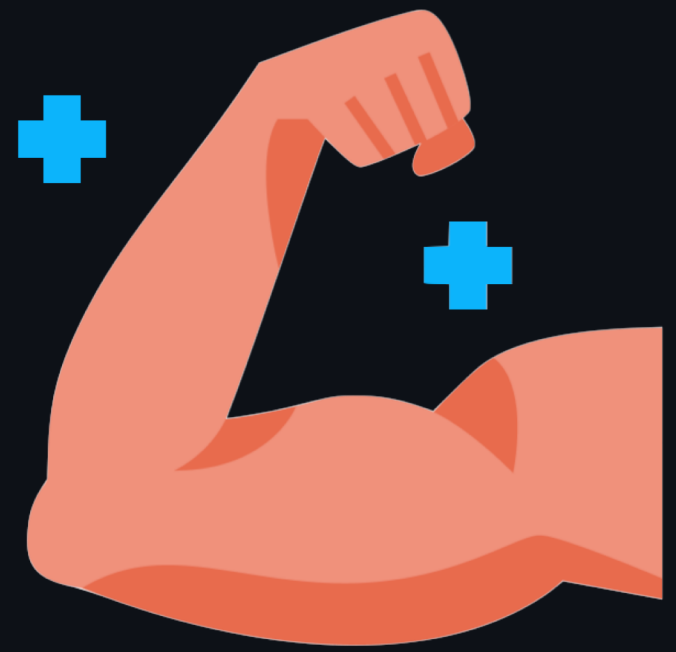
Overview

We will be taking heavy inspiration from:

- DataFusion
- Velox
- InfluxDB
    - which is built on top of DataFusion

Our Design Goals

- Robustness
- Modularity
- Extensibility
- Forward Compatibility



Features

- Encode behavior in the type system
- Provide bare minimum statistics the optimizer needs
  - Timing
  - Cardinality

List of rust crates we plan to use

- `arrow`: for handling the Apache Arrow format
- `tokio`: high performance `async` runtime
- `rayon`: data parallelism crate
- `datafusion`: for the input of physical plans

Design Rationale

Push vs Pull Based

Push	Pull
Improves cache efficiency by removing control flow logic	Easier to implement
Forking is efficient: You push a thing only once	Operators like LIMIT make their producers aware of when to stop running (Headache for the optimizer)
Parallelization is easier	Parallelization is harder

Step 1: Finalize Interfaces

Finalize API with other teams:

- I/O Service
- Catalog
- Scheduler

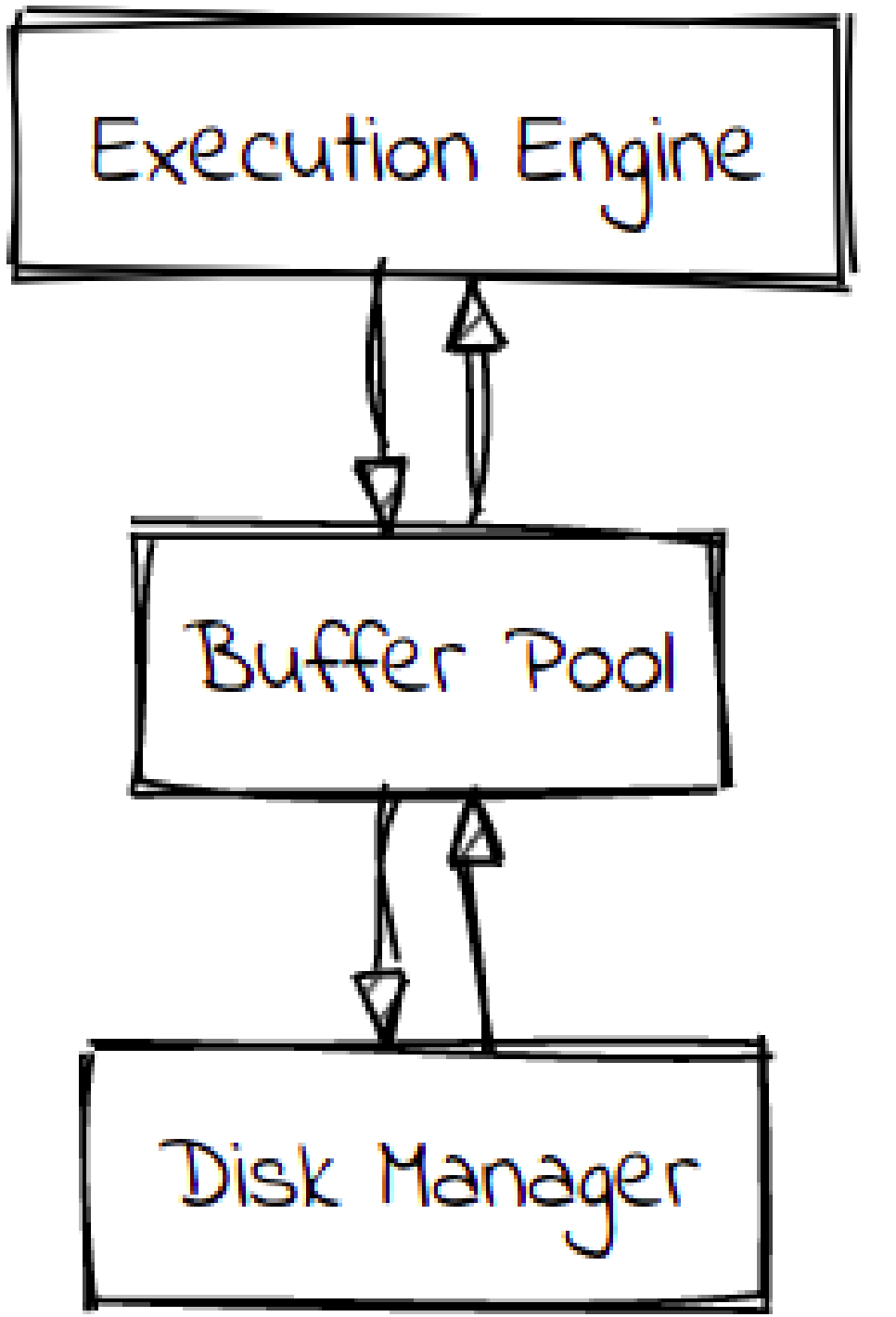
Step 2: Implement operators in memory

- TableScan
- Filter (Completed)
- Projection (Completed)
- HashAggregation (In-Progress)
- HashProbe + HashBuild (In-Progress)
- OrderBy (Completed)
- TopN (Completed)
- Exchange
- More may be added as a stretch goal.

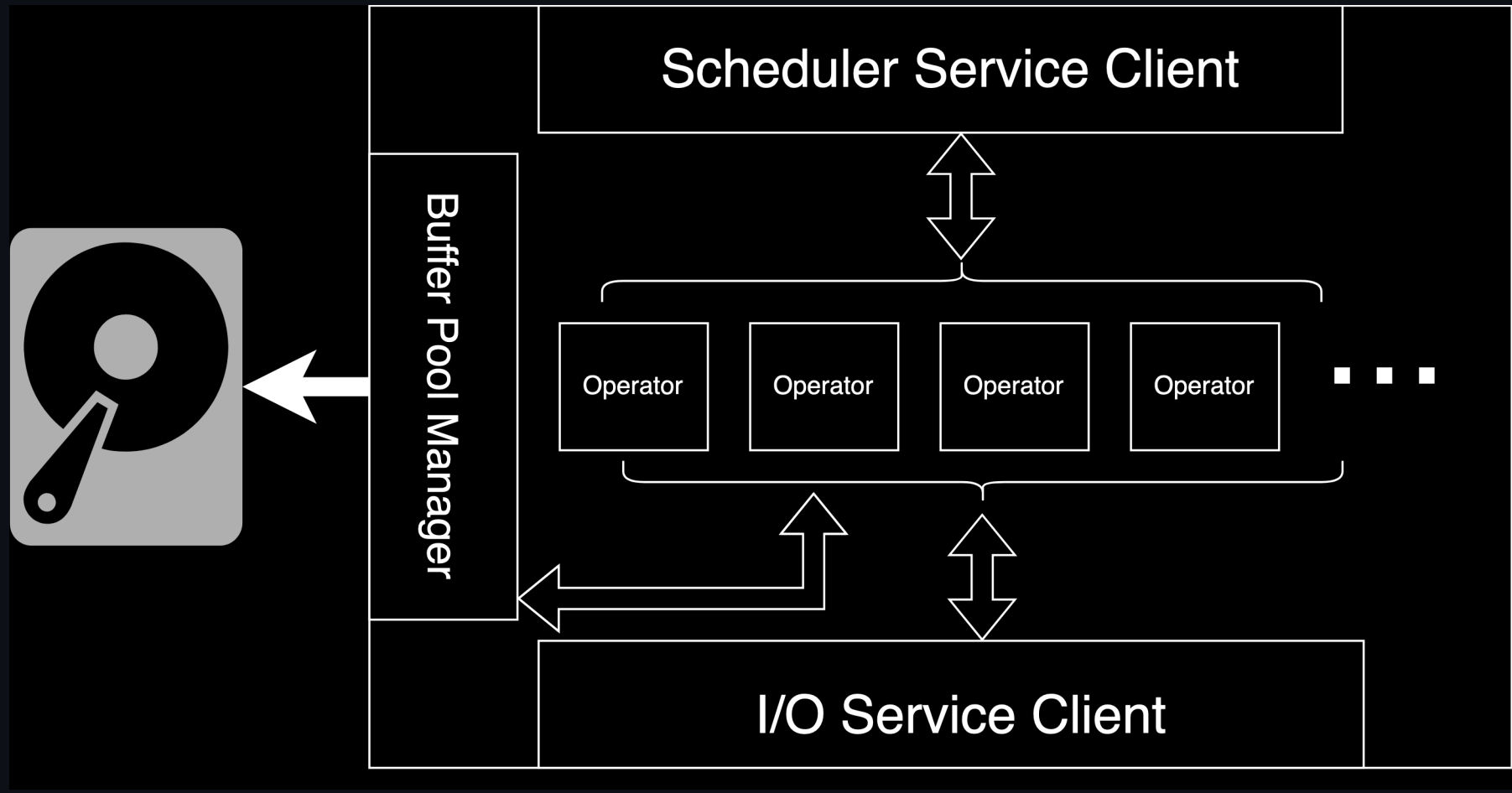
Step 3: Buffer Pool Manager

Need to spill the data to local disk.

- Can potentially rip out the `memory_pool`



Final Design



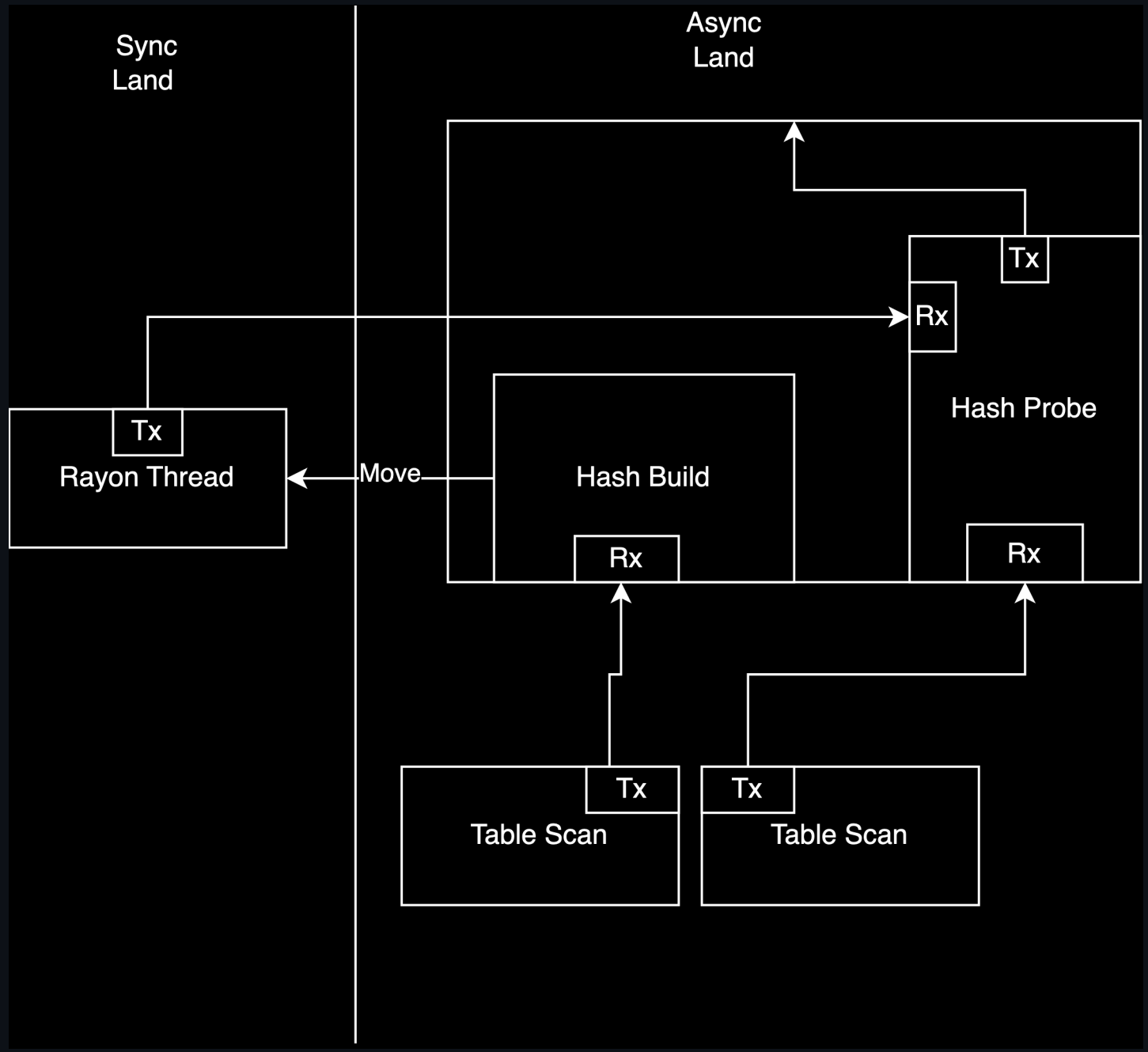
Testing

- Unit tests for each operator
- Timing each operator's performance to benchmark our code

For the sake of code quality...

- Pair programming (all combinations: KC, KS, CS)
- Unit testing for each operator
- Integrated tests across mutliple operators

Example Operator Workflow



Goals

- 75%: First 7 operators working + integration with other components
- 100%: All operators listed above working
- 125%: TPC-H benchmark working

Stretch Goal

- Integrating with a DBMS
- Testing against TPC-H or TPC-H like workload
- Add a lot of statistics and timers to each operator (for optimizer's sake)