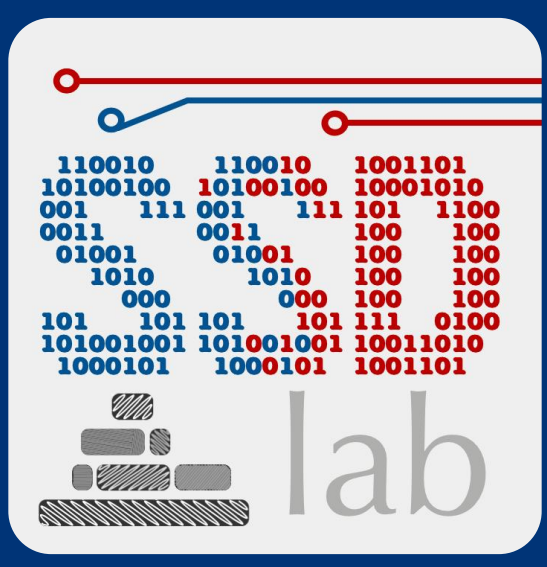




Workload-Aware, Self-Designing Buffers in LSM-Engines

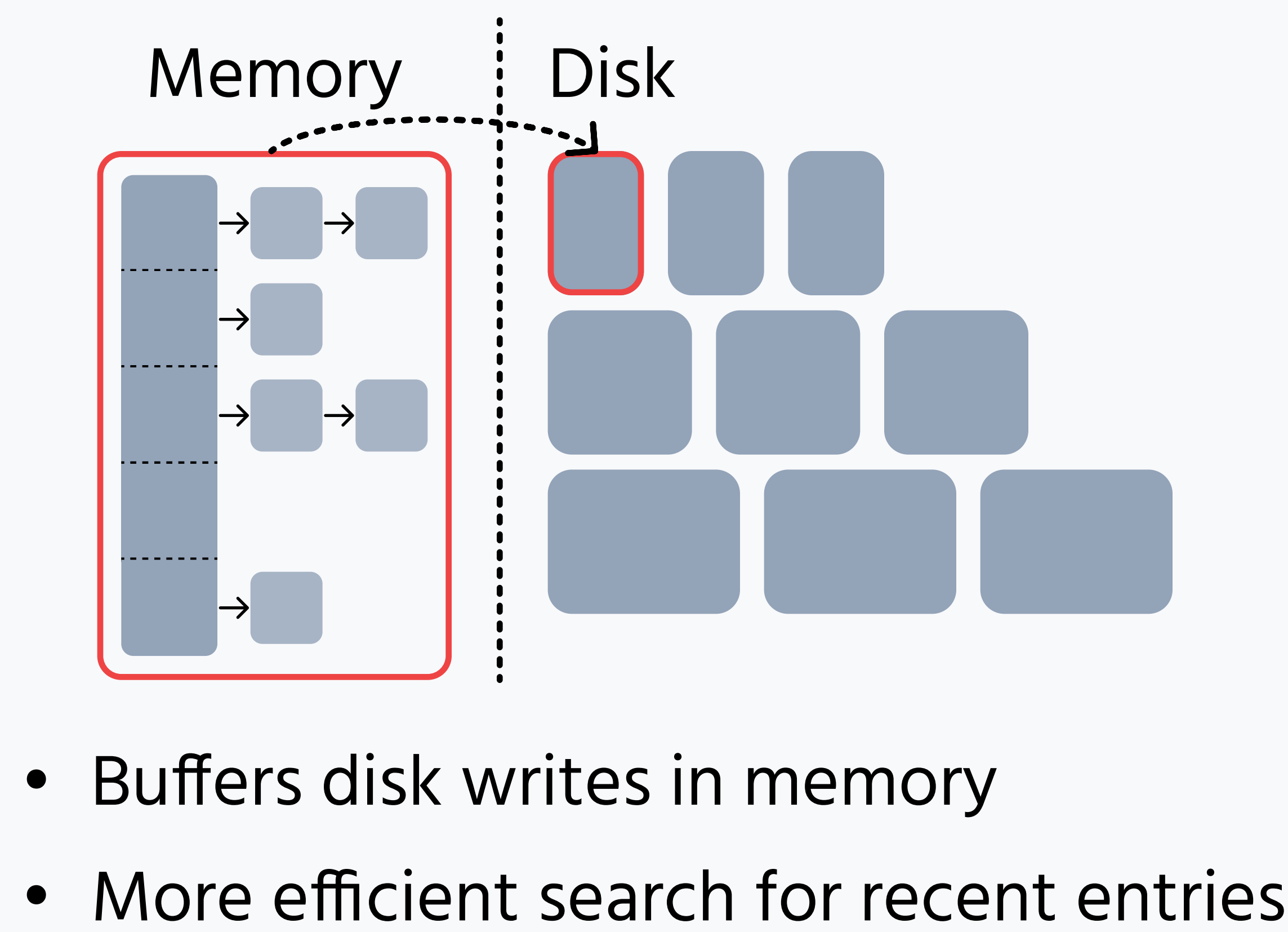
Alexander Ott, Subhadeep Sarkar

LSM Mem Buffers

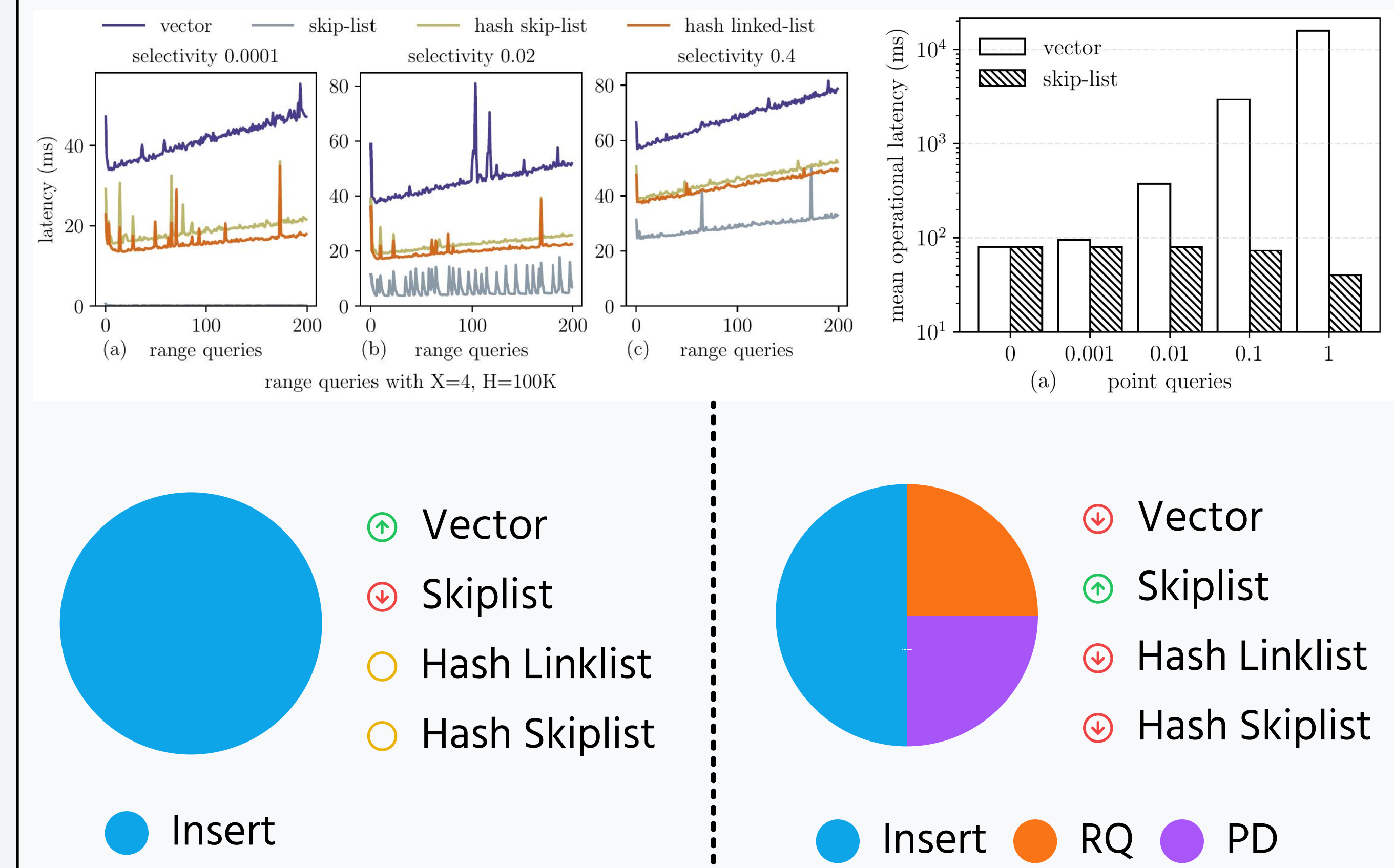
LSMs Everywhere



LSM Memory Buffer

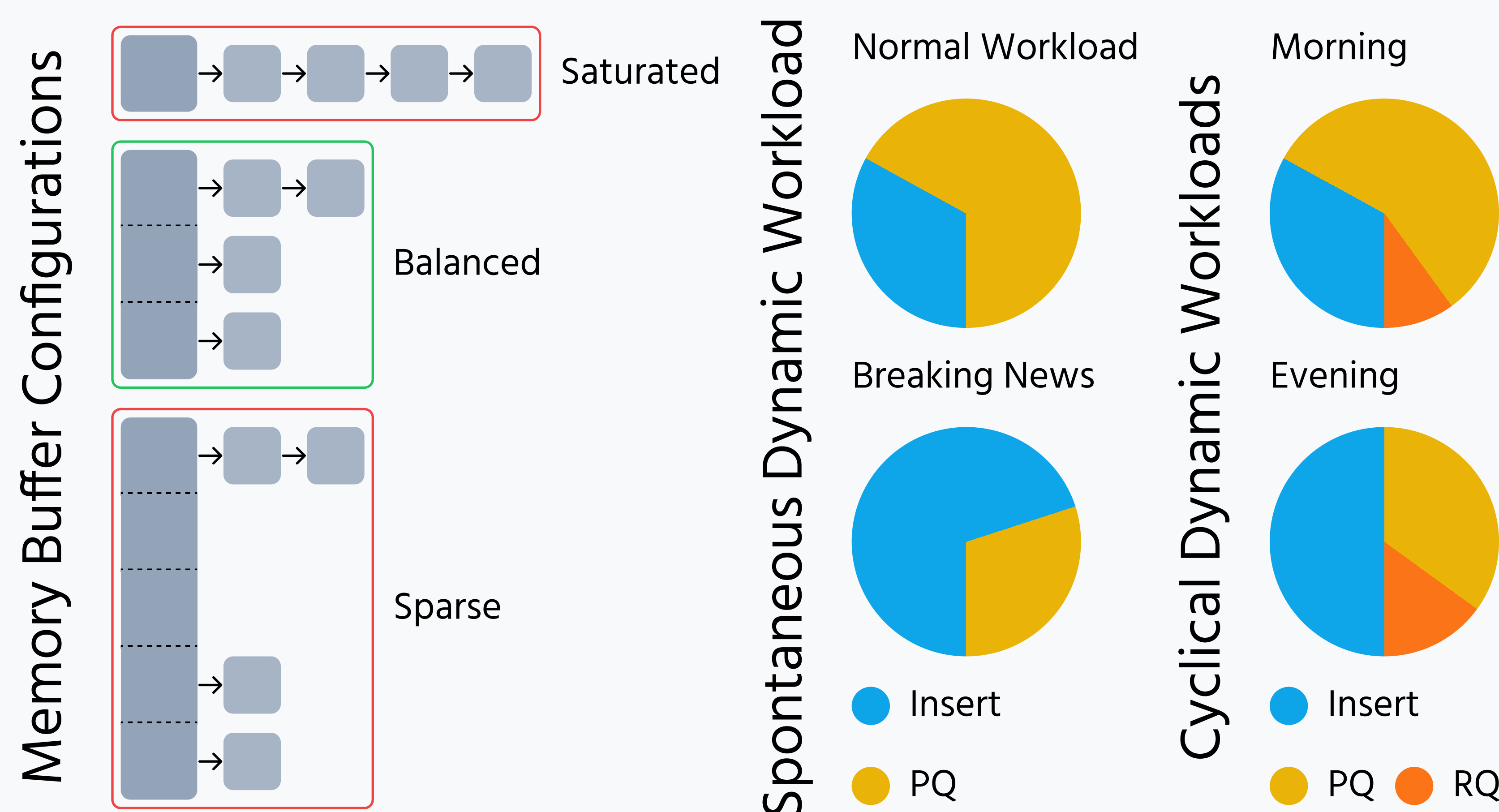


Buffer Performance



The Problem

Buffer Configuration & Dynamic Workloads



Formal Definition

- only a few memory buffer implementations to use
- strengths and weaknesses of memory buffers are not known

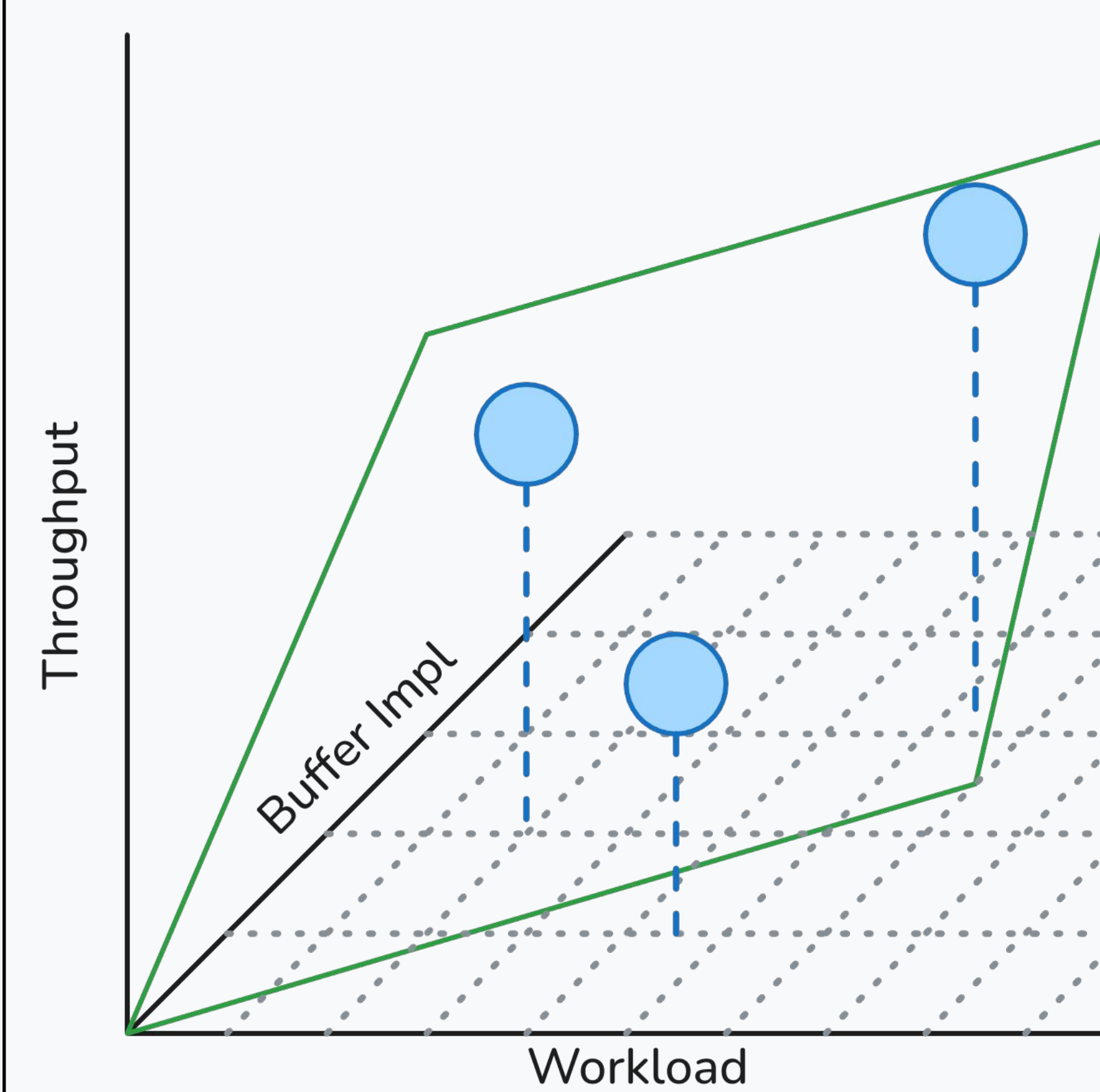
Approximate the function $f(C, w_{t-1}) \rightarrow c_t$ where C is a subspace of the configuration space, w_{t-1} is the previous workload, and c_t is the new configuration. Given an approximation of f , optimize $o(c_t) \rightarrow p_t$, where p_t is the desired performance metric, e.g. minimizing insert latency, maximizing throughput.

Solution

Experimentation & Implementation

- implemented a vector that is not sorted during queries
- implemented a memory buffer using the trie data structure, which is more space efficient
- dissect existing memory buffer implementations and experimentally evaluate their performance tradeoffs
- added ability to dynamically configure RocksDB at runtime
- designed an ML-model that suggests the best buffer configuration for a given workload

ML Optimization using TPE+CMA-ES

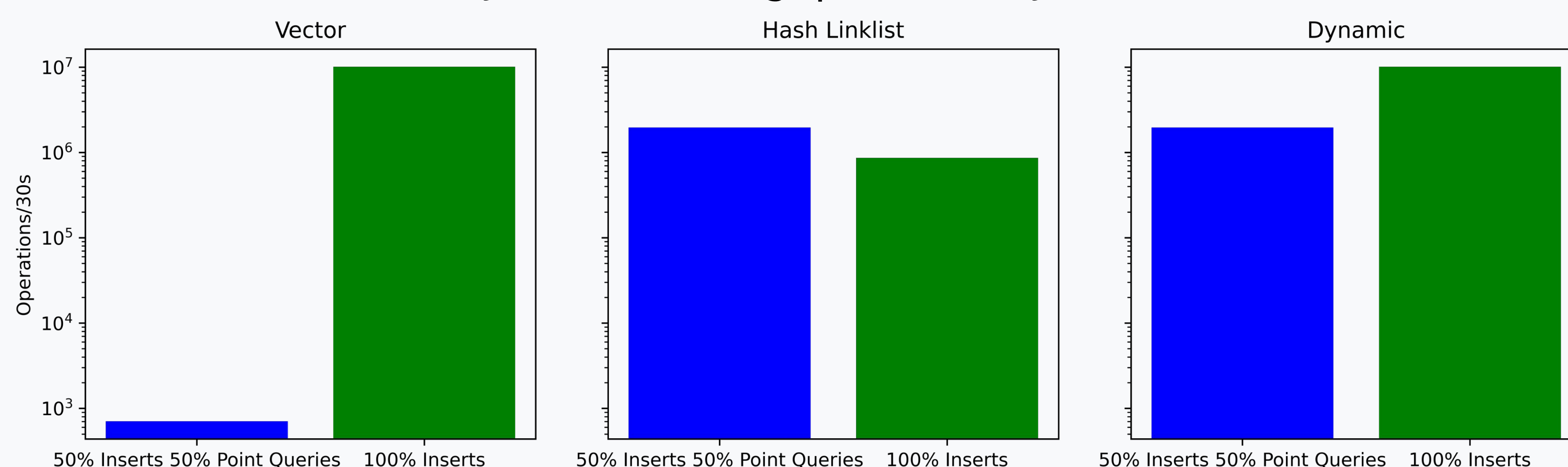


- Goal: optimize objective function
- Surrogate Model: Approximation of the objective function
- Acquisition function: Dictates the next location to sample, balancing between exploration and exploitation

Results

Effectiveness

Mean Memory Buffer Throughput for a Dynamic Workload



- dynamic memory buffer is able to achieve high throughput in both sections of the workload

Future work

- Exploring more memory buffer implementations
 - concurrency
 - hash trie
- Introducing more knobs to optimize
 - bucket count and prefix length for hash memory buffers
- Add more optimization targets

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