ENDURE: A Robust Tuning Paradigm for LSM Trees Under Workload Uncertainty
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The LSM Tuning Problem

Flexibility for applications

Cost is sum of expected I/Os per query type, weight by frequency

Empty Reads : \( z_0 \)  Non-Empty Reads : \( z_1 \)  Range Reads : \( q \)  Writes : \( w \)

Both problems are finding the design \( \Phi \) that minimizes \( C \).

Nominal bases on \( w \), while Robust considers all workloads in \( U^w_\Psi \).

\( w \) : Workload \( (z_0, z_1, q, w) \)
\( \Phi \) : LSM Tree Design \( (m_{\text{buff}}, m_{\text{filter}}, T, \pi) \)
\( C \) : Cost \( (I/O) \)

\( \Phi^* = \arg\min_{\Phi} C(w, \Phi) \)  Nominal

\( \Psi^* = \arg\min_{\Psi} C(w, \Psi) \)  Robust

Uncertainty neighborhood of workloads

Nominal tuning may lead to suboptimal tunings if observed workloads and expected workloads are far.

Robust tuning solution minimizes highest value among any workload in our uncertainty neighborhood.

Uncertainty neighborhood defines which workloads to consider for robust tuning.

Selected Results (More can be found in our full paper)

ENDURE: Robust Tuning

Workload Characteristic

System Information

Page Size

Memory Budget

Expected performance

ENDURE solves the Robust Problem

Users provide workload characteristics: expected workload and uncertainty

Selected Results

RocksDB instance

10 million unique key-value pairs of size 1kB

6 sessions with 5 observation periods per session

Observation period: 200K queries

Overall 6 million queries

Writes are unique

Range queries are short range queries (1-2 pages)

Small subset of results! Take a look at our paper for a more detailed analysis

github.com/BU-DiSC/endure