**System Evaluation**

**System:**
1. Solar
2. VoltDB
3. Tell
4. MySQL-Cluster
5. Oceanbase

**Benchmark:**
1. TPC-C
2. Smallbank
3. E-commerce

**Hardware:**
1. 11 nodes
2. 1/10 Gigabytes switch

**Overview**

- **Processing Layer:**
  - P-unit
  - T-node
  - S-node

- **Transaction Layer:**
  - Storage Layer
  - Fine-grained remote data access
  - High performance in-memory transaction
  - A shared-everything architecture

- **Design Considerations:**
  - No assumption on workloads
  - Do not rely on advanced hardwares

**Transaction Process**

**Execution**
1. Acquire a read-time stamp (rts)
2. Read & execute & buffer writes locally

**Validation**
1. Acquire latches and check there is no new versions for records in write set

**Commit**
1. Create new versions
2. Flush redo log entries

**Compaction**
1. (1) Start
2. (2) Create a new version of SSTable (s) by merging s0 and mS

**Concurrency Control**
1. Type 1: validate and write on mS
2. Type 2: validate on mS and m0, write on mS
3. Type 3: validate and write on m0

**Data Recovery**
1. Persist a compaction log entry (CLE) when the data compaction is started
2. Data recovery starts from the CLE of the last finished data compaction

**Data Access Optimizations**

- **Asynchronous Bit Array**
  - Filter useless T-node read

- **Transaction Compilation**
  - Pre-execute S-node read
  - Group T-node read

**Data Compaction**

- **SSTable Cache**
  - Avoid duplicate S-node read
  - Cache immutable SSTable on P-units

**LSM-Tree style storage**

- **SSTable:** a consistent snapshot
- **Memtable:** newly committed data

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**References**

- Tao Zhu, Zhuoyue Zhao, Feifei Li, Weining Qian, Aoying Zhou, Dong Xie, Ryan Stutsman, Haining Li, Huiqi Hu.
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