One Size Almost Fits All™
Disk-Oriented Overhead
Measured CPU Cycles

- BUFFER POOL: 30%
- LOCKING: 28%
- RECOVERY: 30%
- REAL WORK: 12%

OLTP THROUGH THE LOOKING GLASS, AND WHAT WE FOUND THERE
H-Store
DISK ORIENTED MAIN MEMORY STORAGE

CONCURRENT EXECUTION

Serial Execution

HEAVYWEIGHT RECOVERY

Compact Logging

H-STORE: A HIGH-PERFORMANCE, DISTRIBUTED MAIN MEMORY TRANSACTION PROCESSING SYSTEM

```sql
SELECT COUNT(*)
FROM votes
WHERE phone_num = ?;
```

```sql
INSERT INTO votes
VALUES (?, ?, ?);
```

```java
run(phoneNum, contestantId, currentTime) {
    result = execute(VoteCount, phoneNum);
    if (result > MAX_VOTES) {
        return (ERROR);
    }
    execute(InsertVote, phoneNum, contestantId, currentTime);
    return (SUCCESS);
}
```
YCSB
50% Reads / 50% Writes

![Graph showing performance comparison between H-Store, MySQL, and MySQL+Memcached](image_url)

- **H-Store**
- **MySQL**
- **MySQL+Memcached**

**txn/sec**

- 0
- 40000
- 80000
- 120000
- 160000

**Elapsed Time**

*Legend: 16x speedup*
Anti-Caching: A New Approach to Swapping in Main Memory OLTP Database Systems

VLDB 2014.
YCSB (2x Memory)
50% Reads / 50% Writes

 txn/sec
H-Store  MySQL  MySQL+Memcached

 Elapsed Time

15x
Anti-Caching

• Overhead Reduction.
• In-Memory Compression.
• Vertical Partitioning.
Next-Generation CPUs

• Concurrency control evaluation on +1000 cores simulated architecture.

• Multiple cores per partition.
S-Store

- Integrate distributed stream processing operators directly inside of an OLTP system.
Non-Blocking Analytics

- Asynchronous Snapshots.
- In-Memory Column Store.
- Query Decomposition.
Transactions on Streams

• ACID properties for streams.

• Open Questions:
  – Transaction boundaries?
  – Interaction of streams & tables?
H-Store

S-Store

N-Store
N-Store

• Transaction processing on non-volatile memory.
  – Memristors / ReRam
  – Phase Change Memory
  – Spintronics
Non-Volatile Memory

• NVM Emulator from Intel.
• Tunable Latencies.
• Accessed as a filesystem.
4 Socket Platform with 3 DIMMs/channel

NVM  DRAM
Non-Volatile Memory

• Stage 1: H-Store + Anti-Cache
• Stage 2: H-Store + mmap()
• Stage 3: N-Store
Escape From Planet Stonebraker

(i.e., Andy Needs to Get Tenure)
Beyond the ‘Stores

• Non-Partitionable Workloads.
• The Poor Man’s Spanner.
• Scientific Databases.

• Self-Organization
• MVCC
Conclusion