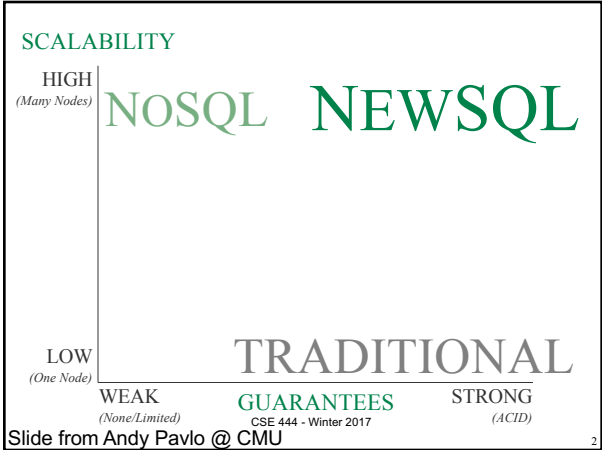


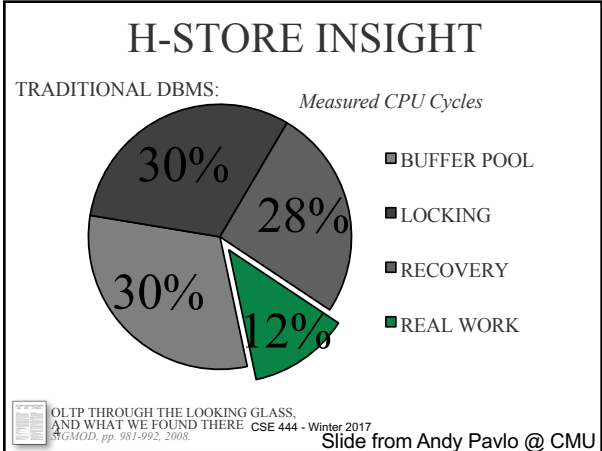
CSE 444: Database Internals

Lecture 27 NewSQL

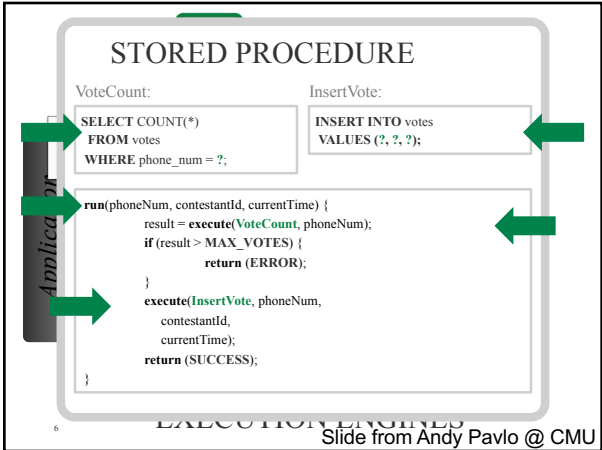
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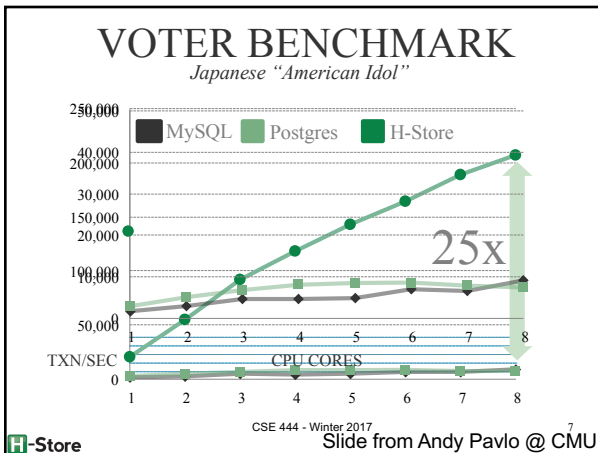


- ### Some Popular NewSQL Systems
- **H-Store**
 - Research system from Brown U., MIT, CMU, and Yale
 - Commercialized as VoltDB
 - **Hekaton**
 - Microsoft
 - Fully integrated into SQL Server
 - **Hyper**
 - Hybrid OLTP/OLAP
 - Research system from TU Munich. Bought by Tableau
 - **Spanner**
 - Google
- CSE 444 - Winter 2017 3



- ### H-Store Key Ideas
- **Main-memory storage**
 - Avoids disk IO costs / buffer pool costs
 - Durability through snapshots + cmd log
 - Replication
 - **Serial execution**
 - One database partition per thread on one core
 - Avoid overheads related to locking
 - **All transactions are stored procedures**
 - Command logging avoids heavy recovery overheads
 - **Avoid distributed transactions**
 - But when needed, run 2PC
- 5





Hekaton

- Focus: DBMS with large main memories and many core CPUs
- Integrated with SQL Server
- Key user-visible features
 - Simply declare a table "memory resident"
 - Hekaton tables are fully durable and transactional, though non-durable tables are also supported
 - Query can touch both Hekaton and regular tables

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Hekaton Key Details

- Idea: To increase transaction throughput must decrease number of instructions / transaction
- Main-memory DBMS
 - Optimize indexes for memory-resident data
 - Durability by logging and checkpointing records to external storage
- No partitioning
 - Any thread can touch any row of any table
- No locking
 - Uses a new MVCC method for isolation

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Hekaton More Details

- Optimized stored procedures
 - Compile statements and stored procedures into customized, highly efficient machine code

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Hyper

- Hybrid OLTP and OLAP
- In-memory data management
 - Including optimized indexes for memory-resident data
 - Data compression for cold data
- Data-centric code generation
 - SQL translated to LLVM
- OLAP separated from OLTP using MVCC
- Exploits hardware transactional memory
- Data shuffling and distribution optimizations

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Conclusion

- Many innovations recently in
 - Big data analytics
 - Transaction processing at very large scale
- Many more problems remain open
- This course teaches foundations
- Innovate with an open mind!

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