Peloton

The **Self-Driving** Database Management System
According to the Bureau of Labor Statistics, Database Administrators earned an average salary of $81,710 in 2015.
What We Can Automate

» Physical Database Design
» Data Placement
» Query Optimization & Tuning
» Knob Configuration
What We Cannot Automate

» Security & Access Controls
» Non-cloud Resource Provisioning
» Data Integration & Cleaning
» Out-of-band Interruptions
» Source Code Version Control
Why We Are Different

» Previous automated tools only dealt with handling problems in the past.

» Humans still make final decisions.

» We can identify cycles/patterns and react before problems occur.
Fall 2015
- Transaction Manager
- Execution Engine
- Storage Manager

Spring 2016
- Logging & Snapshots
- Better Concurrency
- Lock-free Indexing
- Adaptive Storage
- Memcache Support

Summer 2016
- Query Compilation
- NVM Optimizations
- “The Brain”
Adaptive Storage

» Change the layout of data overtime based on how it is accessed.

» Data is transformed from OLTP optimized format to OLAP optimized format.

» SIGMOD 2016
Adaptive Storage

**Original Data**

```sql
SELECT AVG(B) FROM myTable WHERE C < "yyy"
```

**Adapted Data**

```sql
UPDATE myTable SET A = 123, B = 456, D = 789 WHERE C = "xxx"
```

**Hot**

**Cold**
NVM Optimizations

» Avoid the overhead of DBMS recovery
» Larger-than-Memory databases
» Write-Behind Logging
» Data Tiering
» WIP Spring 2016
Write-Behind Logging

UPDATE myTable
SET A = 123,
WHERE C = "xxx"

PCOMMIT

001:Txn1-0x0001
The Brain

» Component that controls all aspects of the DBMS to support autonomous operation.

» Lots of papers. This is going to take a while...
The Brain

» Part #1: Forecaster
» Part #2: Controller
» Part #3: Optimization Generator
» Part #4: Executor
Human vs. Machine

TPC-C Workload – MySQL (v5.7)

Throughput (txn/sec)

- Default
- MySQL Tuner
- DBA
- OtterTune
PDL Database News
Deduplication for Database Replication
Lianhong Xu, et al. (SoCC 2015)

Hybrid OLTP In-Memory Indexes
Huanchen Zhang, et al. (SIGMOD 2016)

Larger-than-Memory Databases
Lin Ma, et al. (DaMON 2016)
Database Systems (15-721)

» Grad-level course on database internals.
» Heavy emphasis on complex systems software engineering.
» All projects completed in Peloton.
» [http://15721.courses.cs.cmu.edu](http://15721.courses.cs.cmu.edu)
PDL DB 2015-2016 Statistics

» # of PhD Students: 4
» # of Post-docs: 1
» # of MS Students: 6
» # of Undergrads: 0
» # of Students Stabbed: 0
Dana Van Aken
2016 National Science Foundation Fellowship
Joy Arulraj
2016 Samsung Fellowship
Peloton

http://pelotondb.org