Architecture and Implementation of Database Systems (Summer 2019)

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Summer 2019
A Few Words About Me

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1996–2001 Diploma in Physics, U Konstanz
2001–2005 Research assistant, DBIS Group, U Konstanz
2005–2007 Research assistant, Database Group, TU München
Oct 2006 PhD in Computer Science (XML query processing)
2007–2008 Postdoc, IBM T. J. Watson Research Center, NY, USA
2008–2013 Senior Researcher, Systems Group, ETH Zurich
since 4/2013 Full Professor, DBIS Group, TU Dortmund University

Topic: Database systems on modern computing hardware
TPC-E Industry Benchmark (modeling a brokerage firm)
- 2.3M customers; 11.5M accounts; 2B holdings; 40B trades
- 18.5 TB initial database size

Current record: **11,059 tpsE** (**110,590 transactions/sec** total)!

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### Numerical Quantities Summary

**Reported Throughput:** 11,058.99 tpsE  
**Configured Customers:** 5,750,000

<table>
<thead>
<tr>
<th>Response Time (in seconds)</th>
<th>Minimum</th>
<th>Average</th>
<th>90\textsuperscript{th} Percentile</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broker-Volume</td>
<td>0.01</td>
<td>0.01</td>
<td>0.03</td>
<td>1.02</td>
</tr>
<tr>
<td>Customer-Position</td>
<td>0.01</td>
<td>0.01</td>
<td>0.02</td>
<td>2.96</td>
</tr>
<tr>
<td>Market-Feed</td>
<td>0.01</td>
<td>0.01</td>
<td>0.02</td>
<td>2.93</td>
</tr>
<tr>
<td>Market-Watch</td>
<td>0.01</td>
<td>0.01</td>
<td>0.02</td>
<td>1.00</td>
</tr>
<tr>
<td>Security-Detail</td>
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<td>0.01</td>
<td>0.01</td>
<td>0.82</td>
</tr>
<tr>
<td>Trade-Lookup</td>
<td>0.01</td>
<td>0.05</td>
<td>0.08</td>
<td>1.03</td>
</tr>
</tbody>
</table>

How can databases provide such throughput, yet be transaction-safe?
Architecture of a DBMS / Course Outline

- Web Forms
- Applications
- SQL Interface

SQL Commands

- Executor
- Operator Evaluator
- Parser
- Optimizer

- Files and Access Methods
- Buffer Manager
- Disk Space Manager
- Transaction Manager
- Lock Manager
- Recovery Manager

DBMS

- data files, indices, ...

Database

Organizational Matters

Lecture

- Mondays, 8–10h, Room OH 12, E.003
- Wednesdays, 10–12h, Room OH 12, E.003
  Please visit this website **regularly**. I will frequently post new information during the semester.

Exercises

- Mondays, 10–12h, Room OH 14, 304  
  
  Thursdays, 14–16h, Room OH 14, 304  
  
  starting **next week**!
- TA: Roland Kühn (roland.kuehn@tu-dortmund.de)
- Register via AsSESS by **Fri, Apr 5, 2019**.
- Participation is not mandatory, but **highly** recommended.
There will be a **written exam**.

- Thursday, July 18, 2019; 14:30h-16:00h; Room HG 2, HS5
- Thursday, September 27, 2019; 13:30-15:00h; Room HG 2, HS5
- duration: 90 minutes
- More information during the semester
I’d like to make this course highly **interactive**.
- Please speak up, discuss, ask questions!

The material we discuss is relevant in **practice**.
- We’ll provide practical examples and exercises.
- You get most out of this course by actively participating in (and solving) the **exercises**.


Alfons Kemper and André Eickler. *Datenbanksysteme: Eine Einführung*. Oldenbourg Verlag.

Dennis Shasha and Philippe Bonet. *Database Tuning*. Morgan-Kaufmann.

... or pick your own favourite in the library — most text books about advanced database topics will do.

I'll also sometimes point to specific research papers and you’re welcome to search for additional background reading. Search engines like Google Scholar are your friend.
Related Offerings

You might also be interested in . . .

. . . the course **Data Processing on Modern Hardware**
  - Winter Semester
  - Many similar concepts, geared to exploit the characteristics of modern computing hardware.

. . . doing your **Master Thesis** with me
  - Chance to participate in the forefront of research.
  - Many ways to join, approach me if you’re interested.