PER STRICKER, THOMAS KALB
07.02.2017, HEART OF TEXAS DB2 USER GROUP, AUSTIN
08.02.2017, DB2 FORUM USER GROUP, DALLAS

DATABASE TRENDS AND HYPES
ITGAIN

- 120 Employees
- Locations Hannover, Hamburg, Atlanta
- Consulting
  - Database Technologies
  - Datamanagement and analysis
  - Mainframe Migration
- Speedgain monitor products
- Mainframe migration products
  - J2U, CM-Tool, IMS Toolset, TRX-Engine, Sort
From problem to cause in one click.

Speedgain for DB2 provides a complete picture of the entire data base system incl. operation system and network. The user can ensure performance and SLAs and can make an aggregated analysis of the SQL workload.

MORE ABOUT SPEEDGAIN FOR DB2

Is your availability optimal? Who causes the load on the database?

Gain full transparency of your Oracle databases with Speedgain for Oracle without having to license ORACLE Enterprise Edition and Diagnostic & Tuning packages.

MORE ABOUT SPEEDGAIN FOR ORACLE

Monitoring of BigSQL just like with SQL

With Speedgain for BigSQL, you can monitor your BigSQL applications just like with the regular SQL application (e.g., with Hadoop, Hbase, or Hive)

MORE ABOUT SPEEDGAIN FOR BIGSQL

Do you keep an eye on your resources? Do you use them effectively?

Speedgain for DataStage enables a complete application monitoring that intelligently combines information from DataStage, the underlying database, and the respective operation system.

MORE ABOUT SPEEDGAIN FOR DATASTAGE
SQL Repayer - New

See in the future

Find the optimal setup
Like a formula 1 race car, tune your database to specific racetrack (workload)

Simulate your business
Increase the number of customers (DB2 Connections)

Test and evaluate alternatives
- MPP (DPF) versus SMP (Non-DPF)
- BLU versus Non-BLU
- AIX versus LINUX
- DB2 versus Postgres

Save money

Minimize your risks
For example if you move into the Cloud

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AGENDA

- Database Trends (Database Evolution)
  - Multi Model Database
  - NewSQL
  - CQL
  - GPU powered Databases
  - Open Source Databases
- Database Hype (Database Revolution)
  - Cognitive Systems (Databases)
  - Blockchain
WHAT DRIVES IT TODAY?

- IoT (Internet of Things)
- Industry 4.0
- TCO (Total Cost of Ownership)
- Business Security
- Security
- Big Data
- Performance
- Availability
- Scalability
- Digital Revolution
- Compression
- License Costs
- Features
GSE Deutsche Jahrestagung München

IT – The next 5 Years?!

“Where is Database Tech headed?”

2010

Thomas Kalb
ITGAIN GmbH
thomas.kalb@itgain.de
TRENDS AND HYPES

SQL

NoSQL
Not Only SQL

Cloud Databases

CPU DATABASE

Cognitive

Integration and Open Source Software

Polyglot Persistence

Polyglot Persistence vs Multi-Model Databases

Copyright © 2016 ITGAIN GmbH
TRENDS AND HYPES

SQL

With a Graph Query Language: Cypher

Cloud Database

Polyglot Persistence vs Multi-Model Databases

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IT TRENDS 2017 – GARTNER

Top 10 Strategic Technology Trends for 2017

Published: 14 October 2016   ID: G00317560

- Trend No. 1: Artificial Intelligence and Advanced Machine Learning (Cognitive Computing)
- Trend No. 2: Intelligent Apps
- Trend No. 3: Intelligent Things
- Trend No. 4: Virtual Reality and Augmented Reality
- Trend No. 5: Digital Twins
- Trend No. 6: Blockchains and Distributed Ledgers
- Trend No. 7: Conversational Systems
- Trend No. 8: Mesh App and Service Architecture
- Trend No. 9: Digital Technology Platforms
- Trend No. 10: Adaptive Security Architecture

http://www.gartner.com/doc/3471559?srcId=1-6595640685#-363727574
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NoSQL Databases

- Types of NoSQL Databases
  - Key-Values Stores
  - Column Family
  - Document Stores
  - Graph Databases
NoSQL Application Integration
Polyglot Persistence
MULTIMODEL DATABASE
SINGLE MODEL NOSQL DATABASE

NoSQL DATABASES: SCALABILITY VERSUS COMPLEXITY

Scalability

Key-Values Store

Column-Family

Document - Stores

Graph - Databases

Internal Complexity
**Multi Model Databases**

- Integration of diverse NoSQL Technologies
- Ability to store data in diverse data formats
  - Key-Value-Pair
  - Documents
  - Graphs
- Query possibilities in each format
- Different types of queries can be combined
- Alternative to Polyglot Persistence Integration
- Databases: OrientDB, ArangoDB, DB2 (with Document Interface (MongoDB Emulation)) or BLU

http://www.slideshare.net/lvca/polyglot-persistence-vs-multimodel-databases
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**NEWSQL**

- SQL + NoSQL => NewSQL
- Merge von NoSQL und SQL
- Scalability of NoSQL + ACID* Guarantee of RDBMS
- Schema free
- Polyglot API

*Atomicity, Consistency, Isolation, Durability*

CQL

- Cypher Query Language
- Developed for Neo4j
- Designed for Graph Databases but could also be used by RDBMS
- No expensive JOINs or Indexes

Cypher:

MATCH (p:Person)-[:EMPLOYEE]-(d:Department)
WHERE d.name = "IT Department"
RETURN p.name

SQL:

SELECT p.name
FROM Person p,
JOIN Department d
ON d.id = p.departmentID
WHERE d.name = "IT Department"
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GPU powered Databases

- Graphics Processor (Graphics Processing Unit)
- GPUs are significantly better than CPUs at parallel processing
- Specialized and optimized processor for massive parallel tasks
- In contrast to the GPU the CPU is much better at universal tasks
- GPUs are well suited for scientific, graphic or data intensive applications
- Share the database operational load across many shoulders
- GPU powered Databases are column based databases
- Ultra-fast reading without indexes

http://diginomica.com/2016/11/16/mongodb-ceo-claims-won-developers-hearts-oracle/
ALENKA – A GPU POWERED DATABASE

Alenka: A GPU-Driven, Open Source Database

At the beginning of October I began looking at an open source, GPU-driven database called Alenka. It’s primary developer, Anton, has been working on it for about four years. Over the following eight weeks, Anton was kind enough to provide guidance on using the software as well as fixing various bugs I had uncovered during my testing.

Alenka uses the Nvidia’s Thrust library’s stable_sort_by_key for sorting, copy_if for filtering and copy_if and transform for grouping and, up until recently, ModernGPU’s RelationalJoin for joining records.

http://tech.marksblogg.com/alenka-open-source-gpu-database.html
DB2 BLU – WITH GPUs

Concurrent execution of an analytical workload on a POWER8 server with K40 GPUs

A Technology Demonstration

Sina Meraji sinamera@ca.ibm.com
Berni Schiefer schiefer@ca.ibm.com

Tuesday March 17th at 12:00 PM, Hall 1-2

https://openpowerfoundation.org/blogs/db2-blu-wgpu-demo-concurrent-execution-of-an-analytical-workload-on-a-power8-server-with-k40-gpus/
DB2 BLU – WITH GPUs

Nvidia GPU

- NVIDIA Tesla K40
  - Kepler technology
  - Peak double precession performance: 1.66 TFLOPs
  - Peak single precession performance: 5 TFLOPs
  - High Memory Bandwidth: up to 288 GB/Sec
  - Memory Size: 12GB
  - Number of cores: 2880

DB2 BLU – WITH GPUs

Hardware Configuration

- POWER8 S824L
  - 2 sockets, 12 cores per socket, SMT-8, 512GB
  - Ubuntu LE 14.04.02 LTS

- GPU:
  - 2 NVIDIA Tesla K40

DB2 BLU – WITH GPUs

Performance Result

~2x improvement in workload throughput
CPU Offload + improved query runtimes are the main factors

Most individual queries improve in end-to-end run time

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OPEN SOURCE DATABASES

Gardner says:

By 2017 not only will 70% of all new business internal applications run on Open Source Databases but 50% of all existing RDBMS are converting to Open Source Licensing models.

http://www.splendiddata.com/
OPEN SOURCE DATABASES

OPEN SOURCE DATABASES

Ranking > Complete Ranking

DB-Engines Ranking

The DB-Engines Ranking ranks database management systems according to their popularity. The ranking is updated monthly.

Read more about the method of calculating the scores.

<table>
<thead>
<tr>
<th>Rank</th>
<th>DBMS</th>
<th>Database Model</th>
<th>Score</th>
<th>Dec 2016</th>
<th>Nov 2016</th>
<th>Dec 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Oracle</td>
<td>Relational DBMS</td>
<td>1404.40</td>
<td>-8.60</td>
<td>-93.15</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>MySQL</td>
<td>Relational DBMS</td>
<td>1374.41</td>
<td>+0.85</td>
<td>+75.87</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Microsoft SQL Server</td>
<td>Relational DBMS</td>
<td>1226.66</td>
<td>+12.86</td>
<td>+103.50</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>PostgreSQL</td>
<td>Relational DBMS</td>
<td>330.02</td>
<td>+4.20</td>
<td>+49.92</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>MongoDB</td>
<td>Document store</td>
<td>328.68</td>
<td>+3.21</td>
<td>+27.29</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>DB2</td>
<td>Relational DBMS</td>
<td>184.34</td>
<td>+2.89</td>
<td>-11.78</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Cassandra</td>
<td>Wide column store</td>
<td>134.28</td>
<td>+0.31</td>
<td>+3.44</td>
<td></td>
</tr>
</tbody>
</table>

312 systems in ranking, December 2016

http://db-engines.com/en/ranking
OPEN SOURCE DATABASES

DB-Engines Ranking - Trend Popularity

- Commercial DBMS
- No growth except for Hana
- No decline either

http://db-engines.com/en/ranking
OPEN SOURCE DATABASES

DB-Engines Ranking - Trend Popularity

- Open Source DBMS
- On the rise but growth is slowing down

http://db-engines.com/en/ranking
OPEN SOURCE DATABASES

- Open Source vs Commercial

Number of systems, December 2016

© 2016. DB-Engines.com

Commerical License: 156
Open Source License: 156

Popularity scores, December 2016

© 2016. DB-Engines.com

Commercial License: 46.1%
Open Source License: 53.9%

Commercial Systems still more popular then Open Source Systems. They will still play a very significant role in the future!

http://db-engines.com/en/ranking_osvsc
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**COGNITIVE COMPUTING**

The term cognitive refers to those human functions that are related to perception, learning, memory and thinking. In other words the relationship between human perception and information processing.

© Online Lexikon für Psychologie und Pädagogik
COGNITIVE COMPUTING
THE START OF THE COGNITIVE ERA – 2011
Cognitive Computing
World of Watson – Las Vegas 2016
COGNITIVE COMPUTING

A significant portion of the digital revolution (Industry 4.0, Big Data)

Digital businesses are disrupting your industry and profession.

60%
of early adopters say cognitive computing is essential to tackling data challenges.

58%
of early adopters view cognitive computing as essential to digital transformation.

50%
of cognitive users share they’re gaining competitive advantage from cognitive initiatives.

COGNITIVE COMPUTING

WHAT ELSE IS THERE BESIDES WATSON?

- Google Deepmind, Google Now, Google TensorFlow
- OpenAI (Tesla, Sam Altman, Amazon, ...)
- Microsoft Cortana
DeepQA is a machine learning library with natural language capabilities.

Thomas J Watson, IBM Founder
COGNITIVE COMPUTING
WATSON COMPONENTS

- Watson Explorer
- Watson Analytics
- Watson Conversation (Email, chat, voice, ....)
- .....
Cognitive Computing

Watson Explorer

- Can be installed locally
- Processes structured and unstructured data
- Real time data analysis
- With the Watson Explorer application builder, it is possible to integrate it into an existing application
- Universal connectors (RDBMs, WEB, Email, etc.)
- A search engine is one of the major components
COGNITIVE COMPUTING
COGNITIVE SECURITY MONITORING (SECURITY 24 x 7) WITH WATSON EXPLORER
COGNITIVE COMPUTING
SPEEDGAIN AND WATSON EXPLORER

Instance A
Instance B
Instance C

Alerting
Performance Data
Threshold overview
Configuration Data

PDB
Database

Speedgain Collector
Cognitive Computing
Watson Analytics

- Guided Data Exploration (Sensible Starting Points)
  - Starting Point and display of further analysis paths (New Perspectives)
  - Natural Language interface
- Understand Outcomes (Interpretation)
  - Pattern Recognition
  - Correlation discovery
  - What are the driving factors? Root cause discovery.
  - Less dependency on expert knowledge
COGNITIVE COMPUTING

SPEEDGAIN WATSON ANALYTICS - ROOT CAUSE I/O

IBM Watson Analytics

What drives APPL_STATUS_UOWEXEC?

Drivers

<table>
<thead>
<tr>
<th>Driver</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVG_GETPAGE_TIME and ROWS_DELETED</td>
<td>74%</td>
</tr>
<tr>
<td>AVG_GETPAGE_TIME and POOL_INDEX_P_READS</td>
<td>67%</td>
</tr>
<tr>
<td>AVG_GETPAGE_TIME and POOL_INDEX_L_READS</td>
<td>64%</td>
</tr>
<tr>
<td>AVG_GETPAGE_TIME and PKG_CACHE_LOOKUPS</td>
<td>62%</td>
</tr>
<tr>
<td>AVG_GETPAGE_TIME and SELECT_SQL_STMTS</td>
<td>62%</td>
</tr>
<tr>
<td>AVG_GETPAGE_TIME and POOL_ASYNC_INDEX_READ_REGS</td>
<td>59%</td>
</tr>
<tr>
<td>AVG_GETPAGE_TIME and POOL_ASYNC_INDEX_READS</td>
<td>59%</td>
</tr>
<tr>
<td>AVG_GETPAGE_TIME and NUM_LOG_WRITE_IO</td>
<td>58%</td>
</tr>
<tr>
<td>AVG_GETPAGE_TIME and POOL_ASYNC_DATA_READ_REGS</td>
<td>58%</td>
</tr>
<tr>
<td>AVG_GETPAGE_TIME and ROWS_SELECTED</td>
<td>58%</td>
</tr>
</tbody>
</table>

View more
Cognitive Computing
SpeedGain Watson Analytics: Cause/Consequence?
COGNITIVE COMPUTING
SPEEDGAIN WATSON ANALYTICS: PAGE-CLEANING-OPTIMIZATION?

IBM Watson Analytics

Drivers

<table>
<thead>
<tr>
<th>Drivers</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>POOL_NO_VICTIM_BUFFER and LOG_HELD BY DIRTY PAGE</td>
<td>45%</td>
</tr>
<tr>
<td>POOL_DATA_L_READS and POOL_READ_RATIO</td>
<td>35%</td>
</tr>
<tr>
<td>POOL_DATA_L_READS and POOL_READ_TIME</td>
<td>34%</td>
</tr>
<tr>
<td>POOL_ASYNC_DATA_READ_REGS and POOL_ASYNC_READ_1</td>
<td>34%</td>
</tr>
<tr>
<td>POOL_ASYNC_DATA_WRITES and POOL_READ_TIME</td>
<td>34%</td>
</tr>
<tr>
<td>POOL_DATA_WRITE and POOL_READ_TIME</td>
<td>34%</td>
</tr>
<tr>
<td>POOL_DATA_P_READS and POOL_READ_RATIO</td>
<td>34%</td>
</tr>
<tr>
<td>POOL_ASYNC_READ_TIME and POOL_DATA_P_READS</td>
<td>33%</td>
</tr>
<tr>
<td>ROWS_INSERTED and PROC_BLOCKED</td>
<td>31%</td>
</tr>
</tbody>
</table>
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Up to now we had an internet of information
The blockchain technology can change this to an internet of values
BLOCKCHAIN
THE IDEA

**BLOCKCHAIN NODES AND MINERS**

- Nodes store copies of the blockchain
- Miners create new blocks and calculate hash codes (proof of work)
- Majority decides in case of conflict (e.g. manipulation attempt)
- Peer to peer network

https://www.linkedin.com/pulse/can-we-reach-consensus-blockchain-robert-eriksson/
**Blockchain Additional Features**

- Inserts Only (INSERT-Database)
- Data cannot be changed
- Scalable
- 99,9999% availability
- Worldwide accessible (P2P)
- Smart Contracts
  - Digital contract
  - Automated clearing
Blockchain
THE INTERNET DATABASE

http://www.onalytica.com/blog/posts/blockchain-top-100-influencers-brands/
**Blockchain**

**Absolutely secure and trustable?**

- Secure by technology
- Not need to trust people or organisations

**BUT**

- **51% attack**
  - Someone how controls more than 50% of the nodes can decide what is wrong and what is right
- **Quantum computers**
  - May have so much computing power that they could be able to manipulate blockchains

**Blockchain**

**Types**

- Public Blockchain (Bitcoin, Ethereum, Ripple, etc)
- Private Blockchain (IBM-Bluemix, Supply-Change-Mgmt)

Private blockchains could make sense for B2B transactions, but

- you need many independent nodes/businesses involved and
- none should control more than 50% of the nodes
**Blockchain**

**Applications**

- Trust
- No manipulation

**Blockchain**

**Application: Car Sharing**

![Diagram showing blockchain application for car sharing](image)

- **Local Application**
- **Company Internal Network**
- **Backend Application**
- **DB**

- **Internet**
- **Internet (Blockchain + Smart Contracts)**

- **Company Internal Network**

**Synchronous transactions**

**Asynchronous transactions**

Database Trends and Hypes

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**Blockchain**

**Bitcoin**

- Larges blockchain
- Created 2008 by Satoshi Nakamoto, who's real identity is unknown
- Virtual currency
- Independent from banks and states
- A different development is the “utility settlement coin” (UBS, Deutsche Bank, Santander and BNY Mellon, as well as the broker ICAP)*
  - real currencies in the blockchain
  - Only used for post-trade settlements between financial institutions (clearing)

Database Trends and Hypes

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**Blockchain**

**Bitgcoin Notes**  [HTTP://COIN.DANCE](http://coin.dance)

![Coin Dance](image-url)

**Coin Dance**

Bitcoin Nodes Summary

27 Bitcoin XT nodes

166 Bitcoin Classic nodes

393 Bitcoin Unlimited nodes

4588 Bitcoin Core nodes

Last updated just now
(Corrected to omit duplicate nodes)
Blockchain (ETH)

HTTPS://ETHEREUM.ORG

- Blockchain with embedded applications
- No Code manipulation
- Java like language
- Ethereum Browser required
- Currency: Ether
**Blockchain**  
**IoT (Internet of Things Database)**

- Prevent manipulation of things
- Execute services from a blockchain
- Smart Contract / pay per use

**Blockchain (ETH - Nodes)**

HTTP://ETHERNODES.ORG/NETWORK/1

- Developed in Europe
- Many nodes in Europe
**Blockchain (ETH - Applications)**

HTTP://DAPPS.ETHERCASTS.COM/
BLOCKCHAIN (ETHEREUM FOUNDER AND DESIGNER)

- Vitalik Buterin
YOUR BUSINESS IS OUR CHALLENGE