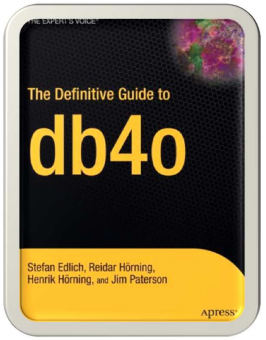
DATABASES = FUN ?

```
select fun, profit from real_world where rational = false
```

Thanks!

Teching Software-Engineering

- **20 years with *Relational Databases***
- **PostgreSQL, SQLite, Oracle ...**



2006

db4o

2004

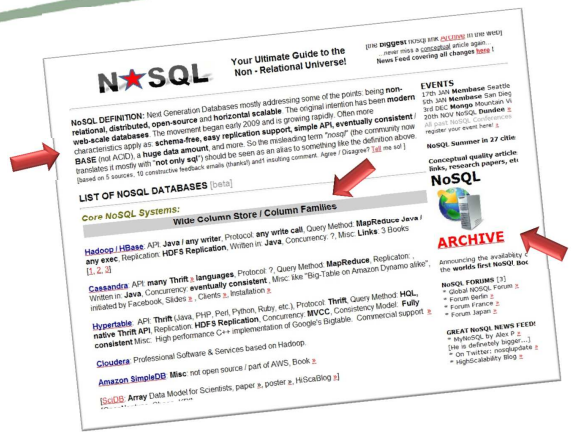
icoodb

2006

2008

http://nosql-database.org

2010



nosqlberlin.de
nosqlfrankfurt.de
nosql powerdays

2010

Oracle, IBM, etc. wollen auch...

NoSQL DEFINITION: Next Generation Databases mostly addressing some of the points: being **non-relational, distributed, open-source** and **horizontal scalable**. The original intention has been **modern web-scale databases**. The movement began early 2009 and is growing rapidly. Often more characteristics apply as: **schema-free, easy replication support, simple API, eventually consistent** / **BASE** (not ACID), a **huge data amount**, and more. So the misleading term *"nosql"* (the community now translates it mostly with "**not only sql**") should be seen as an alias to something like the definition above.

Und nicht vergessen...

Einfache Installation / Handling + Fun!

non-relational

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Scale-out!

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Open-Source

nur indirekte finanzielle Interessen

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Web-Scale

Historie

Google

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Schema free

Strange Loop Pattern:

Design for Crash!

ERLANG

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Replication fun?

```
POST /_replicate HTTP/1.1
{"source":"database","target":"http://example.org/database"}
```

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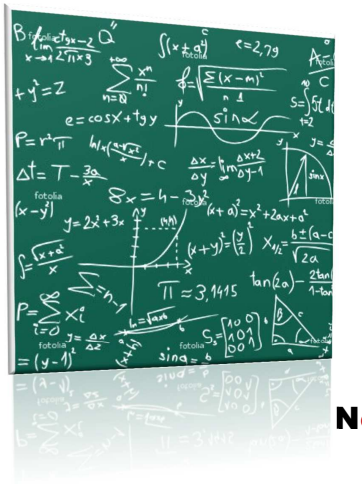
kommt noch...

a NOSQL summer

nosqltapes.com !

JAPAN

NoSQL is specialization!



NoSQL foundations:

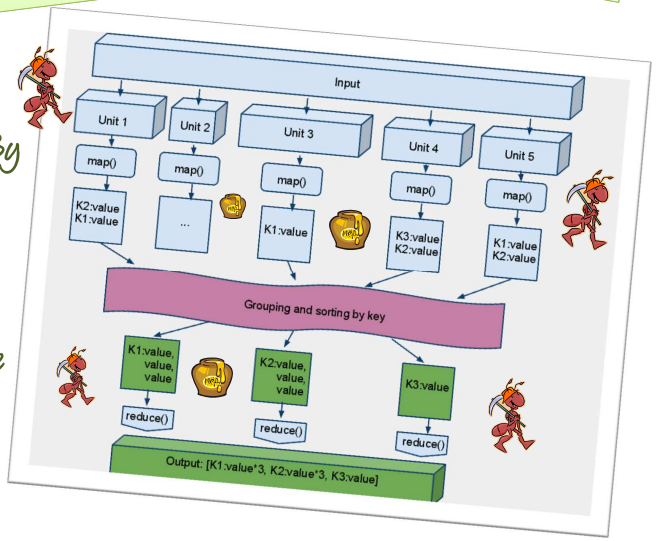
Theorie

funktionale (graph) Dekomposition? Oder…

Schutzpatent ☺

Group By

Aggregate



Programmierung top!

herrlich parallelisierbar

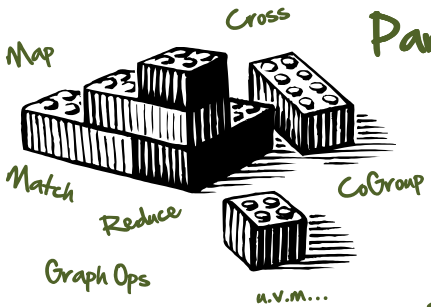
Programmierung nervt!

Nur `large data indexing`

„A giant step back! Incompatible, missing features, not new, …"

Starke Konkurrenz: Stratosphere (TUB), ePic, SwissBox, etc.

Parallelization Contracts



compile, analyze, optimize

auf einer atmenden Cloud!

Eventually Consistent

ACID

- Amazon Dynamo
- MySQL Replikation

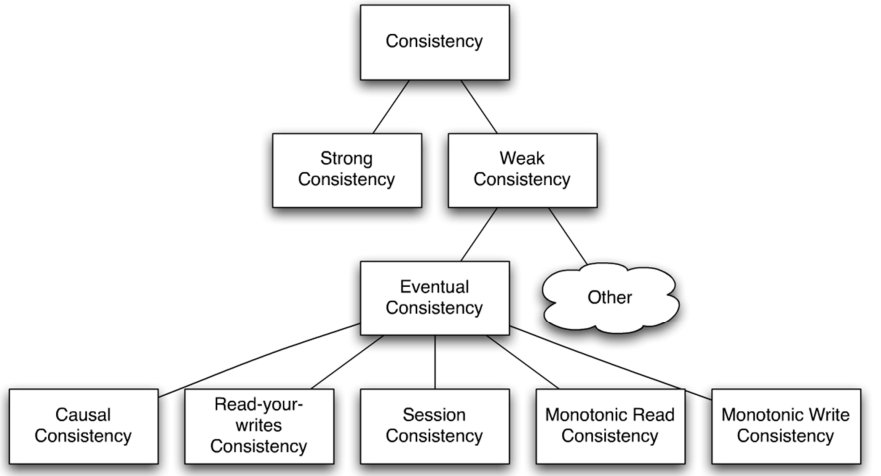
BASE

facebook

myspace

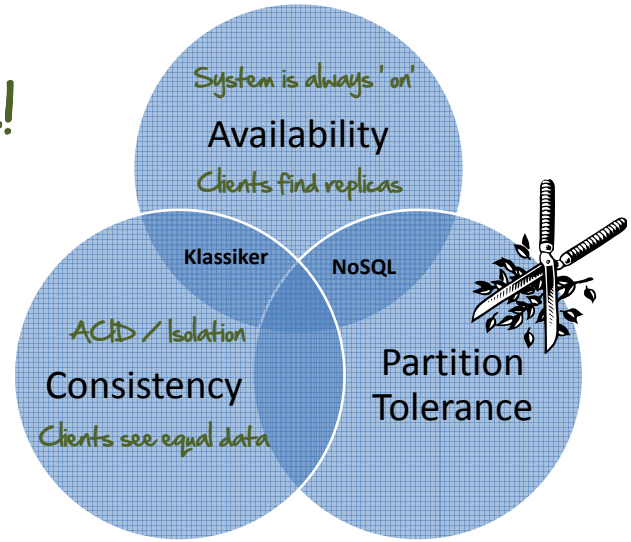
twitter

Consistency Models



CAP Theoreme

Pick 2!



„Don't throw **C** away so easy! It's complex."

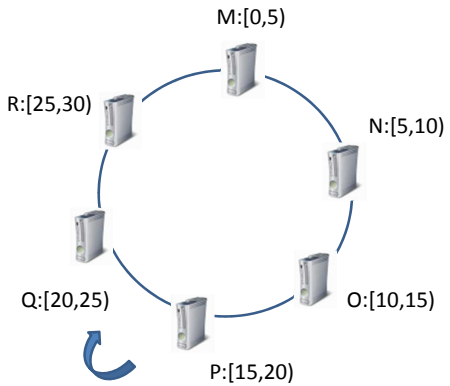
What you really have is:

1. Application errors ★
2. Repetable DBMS errors ★
3. Unrepeatable DBMS errors
4. Operating System errors
5. Hardware failure in cluster
6. Network partition in local cluster
7. A disaster ★
8. WAN failure

- 6 = Network Partition is rare
- 3,4,5,6 is mostly a Single Node
- Algorithms can help!

„give up P rather than sacrificing C. Use VoltDB or NimbusDB"

Consistent Hashing



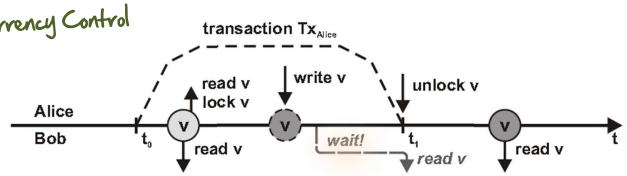
HASH	KNOTEN	REPLIKAT
2	M	N,O
8	N	O,P
10	O	P,Q
17	P	Q,R
22	Q	R,M
26	R	M,N

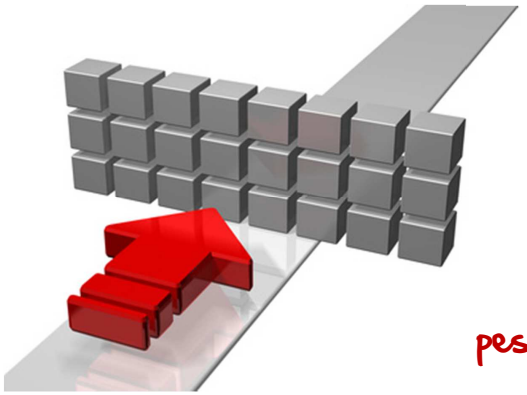
W ✓= 2*W
R ✓= 1*R

- ausfallsicher ✓
- leicht erweiterbar ✓
- gut verteilt / vnodes ✓

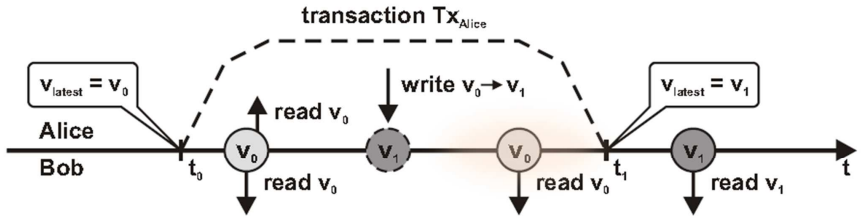
MVCC

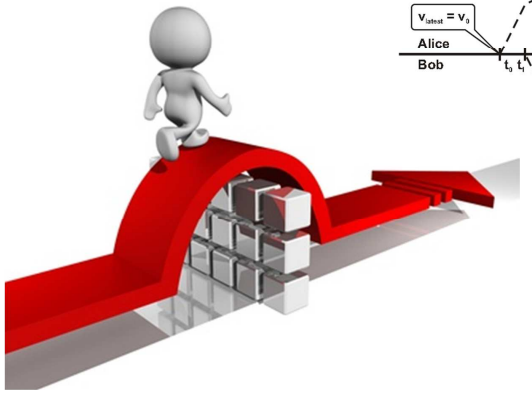
Multi Version Concurrency Control

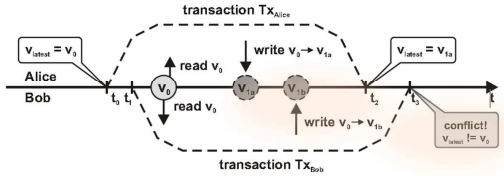




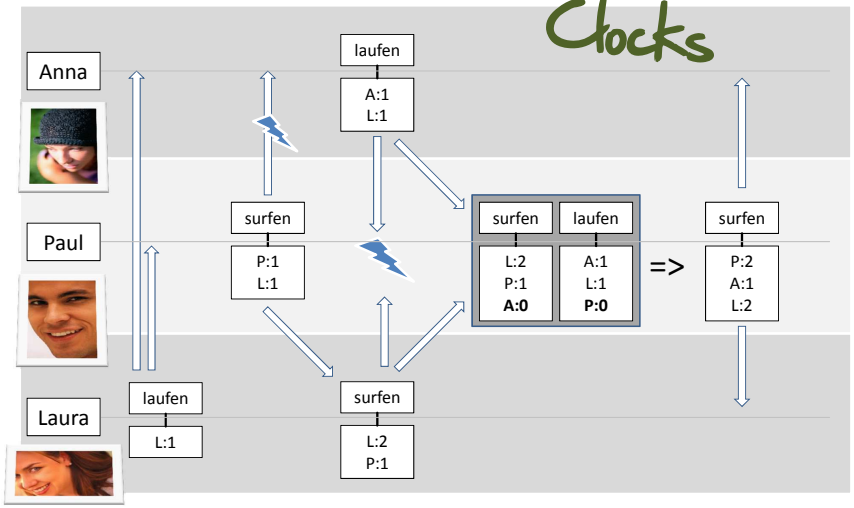
pessimistisches Locking?

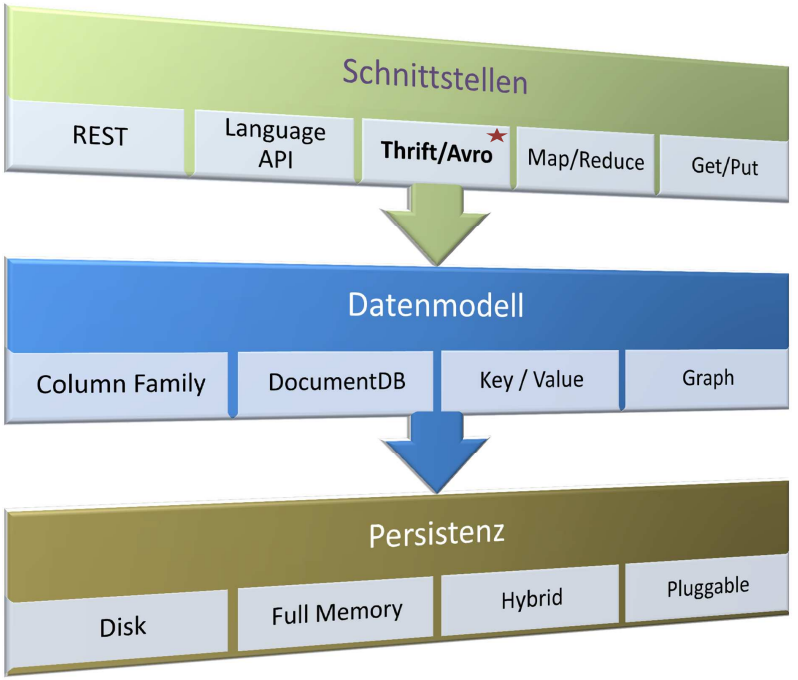






Vector Clocks





Google Protocol Buffers

You write a `.proto` file like this:

```
message Person {
  required int32 id = 1;
  required string name = 2;
  optional string email = 3;
}
```

Then you compile it with `protoc`, the protocol buffer compiler, to produce code in

Then, if you are using C++, you use that code like this:

```
Person person;
person.set_id(123);
person.set_name("Bob");
```

Thrift

```
struct UserProfile {
  1: i32 uid,
  2: string name,
  3: string blurb
}
service UserStorage {
  void store(1: UserProfile user),
  UserProfile retrieve(1: i32 uid)
}
```

=>

```
# Make an object
up = UserProfile(uid=1,
                 name="Mark Slee",
                 blurb="I'll find something to put here."

# Talk to a server via TCP sockets, using a binary protoc
transport = TSocket.TSocket("localhost", 9090)
transport.open()
protocol = TBinaryProtocol.TBinaryProtocol(transport)

# Use the service we already defined
service = UserStorage.Client(protocol)
service.store(up)

# Retrieve something as well
up2 = service.retrieve(2)
```

- JSON!
- Binary data transfer
- automatic RPC generation
- no code generation
- Client + Server tauschen Schema bei Änderung

Daten-Modelle

Relationale DB	Server	Database	Table	Primary Key			
Key Value DB	Cluster	Keyspace		Key	Value		
Column Family DB	Cluster	Table / Keyspace	Column Family	Key	Column Name	Column Value	Super Column optional
Document DB	Cluster	Docspace		Doc Name	Doc Content		
GraphDB	Server	Nodespace	Nodes & Links				

Wide Column Stores / Column Families

```
KEY_1 => COLUMN_FAMILY_ONE => A => Value
                           => B => Value
      => COLUMN_FAMILY_TWO => C => Value

KEY_2 => COLUMN_FAMILY_ONE => A => Value
                           => D => Value
      => COLUMN_FAMILY_TWO => B => Value

KEY_3 => COLUMN_FAMILY_ONE => A => Value
                           => B => Value
                           => F => Value
      => COLUMN_FAMILY_TWO => C => Value
                           => D => Value
```

```
Keyspace:WildWest
CF:Users
  "Jim"   {„reactivity":"2"}
  "Joe"   {„reactivity":"9"   „nick_name":"Little Joe"}
CF:Horses
  "Kelly" {"color":"white"    "owner":"Jim"}
CF:Weapons
  "Colt"  {"anno":"15"        "owner":"Joe"}
CF:Duels
  "High_Noon"  {"player_1":"Jim"   "player_2":"Joe"   "winner":"Joe"}
CF:Messages
  "High_Noon_1" {"from":"Joe"   "to":"Jim"   "text":"Looooser!"}
```

+super

Kunden-ID	Vorname	Nachname	Straße	Stadt	Land	PLZ	Telefon	E-Mail
123	Robert	Schmidt	Hauptstr. 123	Düsseldorf	Deutschland	40210	222-333-4444	
456	Jens	Hansen	Bahnhofstraße 456	Köln	Deutschland	50441	333-444-5555	
789	Doris	Thomas	Schillerstraße 789	München	Deutschland	80331	444-555-6666	dthomas@xyz.com

+N

Column Family

DocumentDBs

Key/ValueDBs

Voldemort, Chordless, Scalaris, Dynamo / Dynomite

GraphDBs

andere

db4o, Versant, Objectivity, Gemstone, Progress, Mark Logic, EMC Momentum, Tamino, GigaSpaces, Hazelcast, Terracotta, ...

hadoop

+ Skalierung = new node
+ Community
+ API
- Replikation
- Aufsetzen, Optimierung, Wartung

amazon SimpleDB

+ stressfreie SaaS Lösung
+ transparent scaling
- UTF-8 String
- Daten liegen bei Amazon
- kein tuning / config

Cassandra

+ Skalierung = new node
+ Replikation
+ Konfiguration (r, w)
- Dokumentation
- Abfragen
- (storage-conf.xml)

Document DBs

Erlang

Views

Lounge

Futon

JSON, semistructured Docs

1 URL Replikation

CouchApps

JS Client

keine Middleware

DB+WebS+App

2. Runde
+= 6,5 Mio $

+ memory mapped, indexes, queries, marketing
- durability, single instance design

67 GB

EC2 Node 66 GB

EC2 Node 66 GB

2 Days off

NoSQL Divergenz: CouchDB = NoNoSQL

NoSQL Konvergenz:

Liquid Data at the bottom (JSON)

besser suchbar

Easy to run,
develop, manage

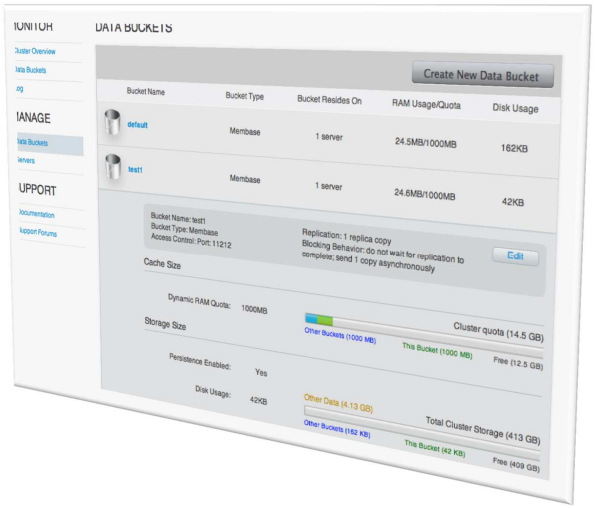
K/V-Stores

Data Structure Server ->

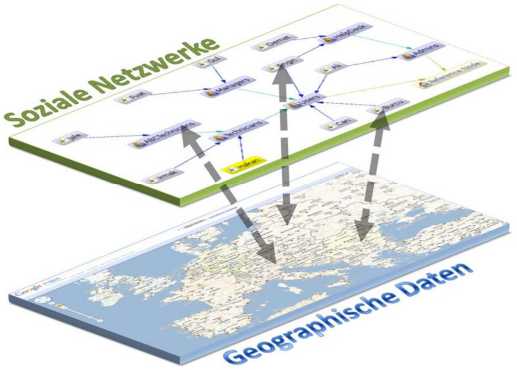
+ sehr schnell > 100.000 / sek
+ konfigurierbarer Disc sync
+ API für eigene Anbindung
+ einfache Replikation
+ hash, list, set, sorted set, messages
+ Installation
  UNIX: 38 sek
  Windows: 18 sek
- noch nicht skalierbar (2.*)

MEMBASE.ORG

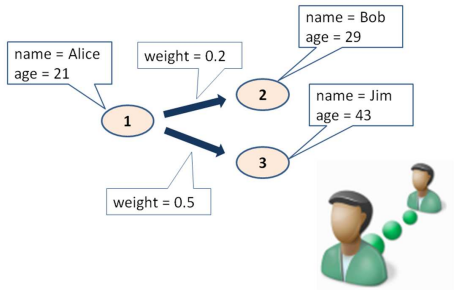
memcached API



GraphDBs



Property Graph



Neo4j, Sones, HyperGraphDB, InfiniteGraph, InfoGrid, Dex, VertexDB, Filament, OrientDB

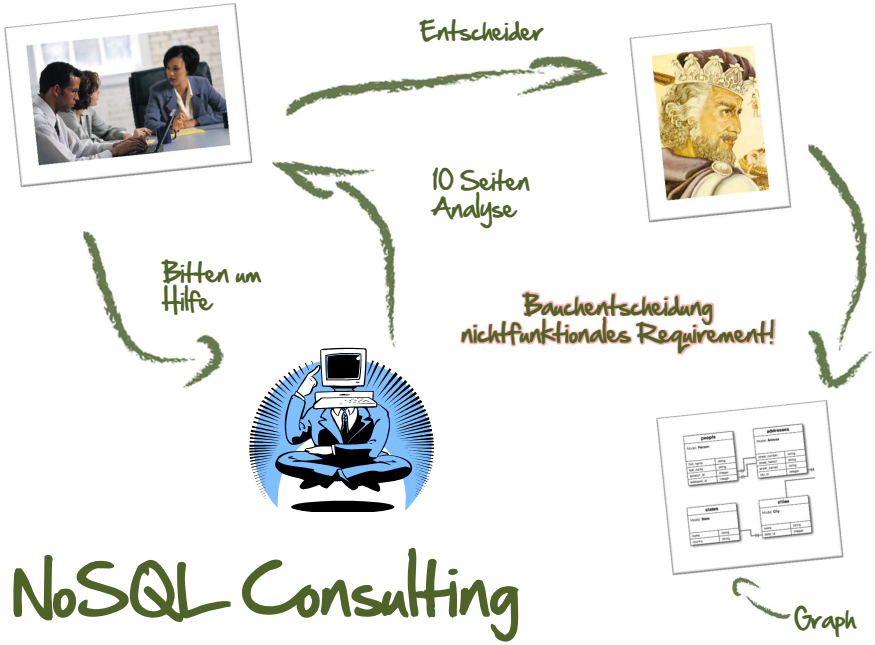
X

DataModel, Query Methods, Languages, License, Protocol

OrientDB

Key / ValueDB + DocumentDB + ObjectDB + GraphDB
+schneller…

> 220 DBs



NoSQL Consulting

Start-Ups ☺

etablierte Unternehmen ☹

1. Data
2. Transactions
3. Performance
4. Queries
5. Architecture
6. other Non-Functional Requirements

Analyse your Data
Domain-Data, Log-Data, Event-Data, Message-Data, critical Data, Business-Data, Meta-Data, temp Data, Session-Data, Geo Data, etc.

Data- / Storage-Model:
relational, column-o, doc-alike, graphs, objects, etc.

What Types / Type-System?
Data-Navigation, Data Amount, Data Komplexity (Deep XML?)

ACID vs. BASE vs. Mixture?
CAP decisions

Performance Dimension Analysis
Latency, Request behaviour, Throughput

Scale-Up vs Scale-Out

Query Requirements
Typical queries, Tools, Ad-Hoc Queries, SQL / LINQ needed, Map/Reduce? ...

Distribution Architecture
local, parallel, distributed / grid, service, cloud, mobile, p2p, ...

Data Access Patterns
read / write distribution, random / sequential, Access Design Patterns

Non Functional Requirements:
Replication, Refactoring Frequency, DB-Support, Qualification / simplicity, Company restrictions, DB diversity (allowed?), Security, Safety / Backup & Restore, Crash Resistance, Licence...

NoSQL

Lessons learned

Think outside the MyOracleSql Box ✓

VoltDB
Vertica
GenieDB
MonetDB
Hadoop++
...

RAM + SSD rocks

RethinkDB


Gustavo Alonso

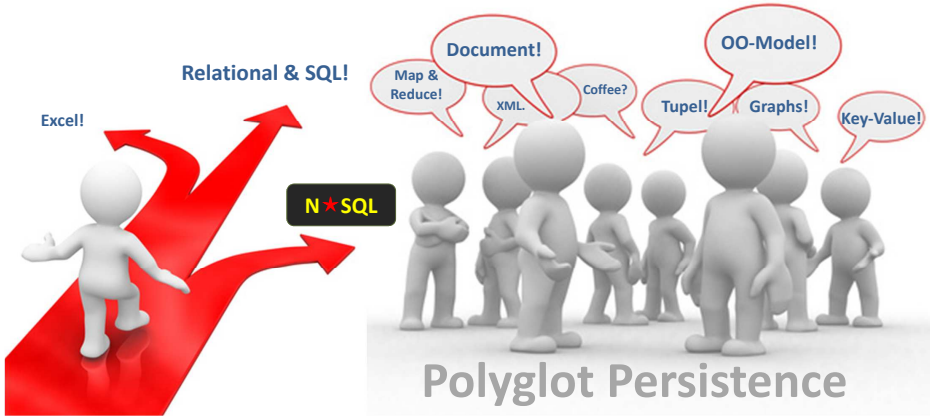
Lot's of >1 PT RAM DBs in CA!

Queries in FPGA !

Tonnen cleverer hybrid Lösungen da!

DaaS => best Mix!

The world is *diverse*! Act accordingly!



Thanks for listening!

http://edlich.de

Diskussion!