FH JOANNEUM
University of Applied Sciences

NoSQL

06.06.2013

About me

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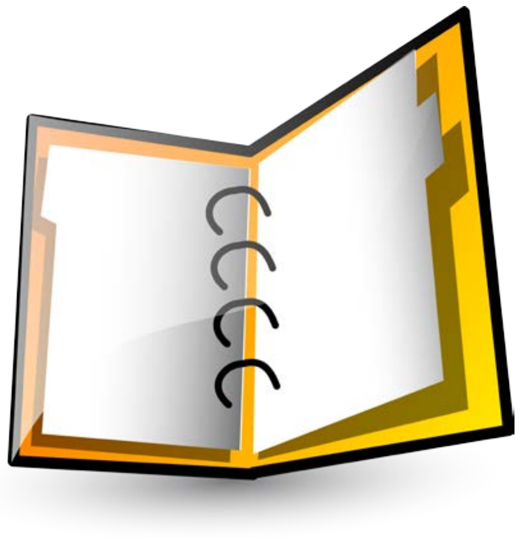
- BSc (FH Joanneum – ITM09)
- currently reaching for MSc
- http://movlib.org

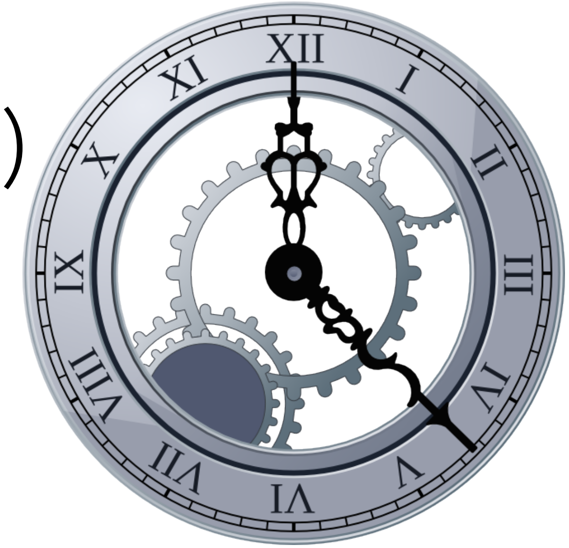
Agenda

- Overview & Definition
- Consistency
- Scaling & MapReduce
- Types of NoSQL
- Demo?



Historical overview

- DBM (1979)
- Lotus Notes, BerkeleyDB (80’s)
- NoSQL (1998)
- Web 2.0 – BigTable (2004)
- The movement (2009)



Definition

“Next Generation Databases mostly addressing some of the points: being **non-relational, distributed, open-source** and **horizontally scalable**.

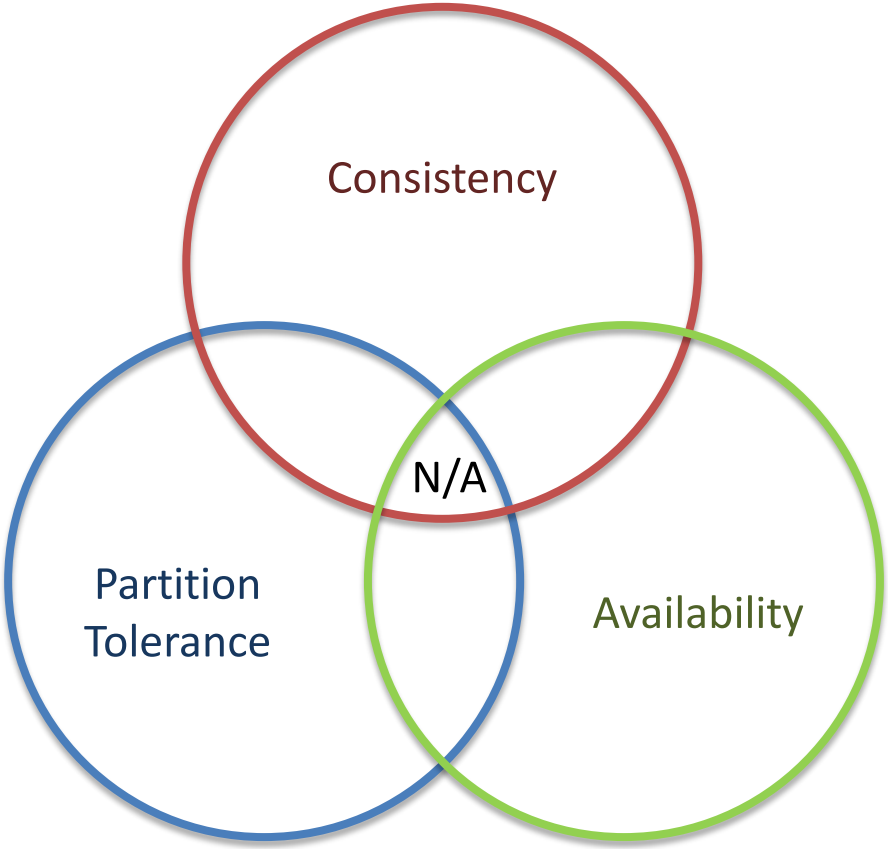
The original intention has been **modern web-scale databases**. The movement began early 2009 and is growing rapidly. Often more characteristics apply such as: **schema-free, easy replication support, simple API, eventually consistent** / **BASE** (not ACID), a **huge amount of data** and more. So the 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.”

- nosql-database.org

Clarification

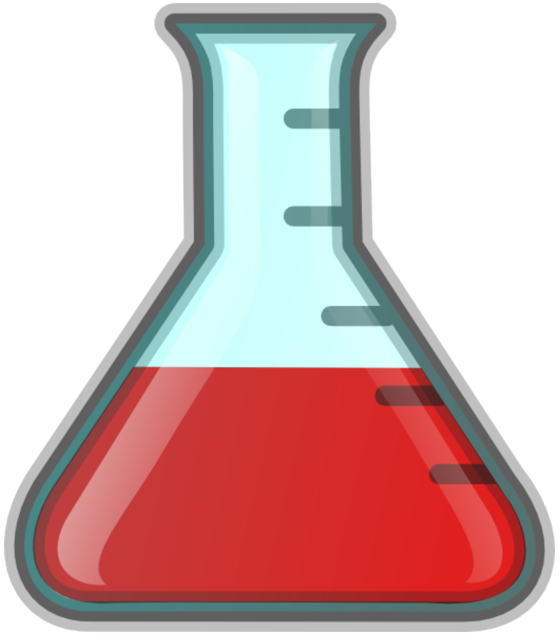
- Web 2.0 needs
- Scalability
- Flexible data models
- Different storage
- Consistency?

Implications



Strong consistency

- **A**tomicity
- **C**onsistency
- **I**solation
- **D**urability

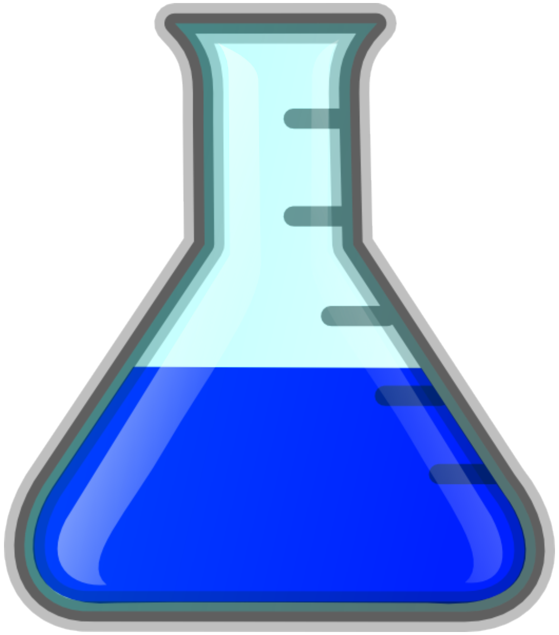


Eventual consistency

- Casual
- Read-your-writes
- Session
- Monotonic read
- Monotonic write

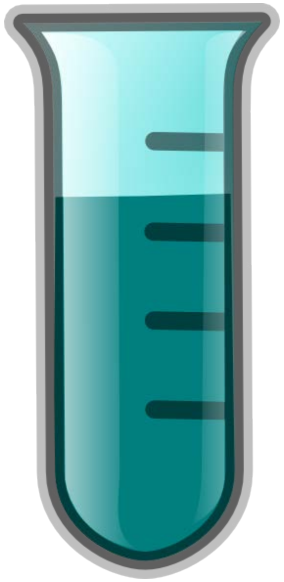
BASE

- **B**asically **A**vailable
- **S**oft state
- **E**ventually consistent



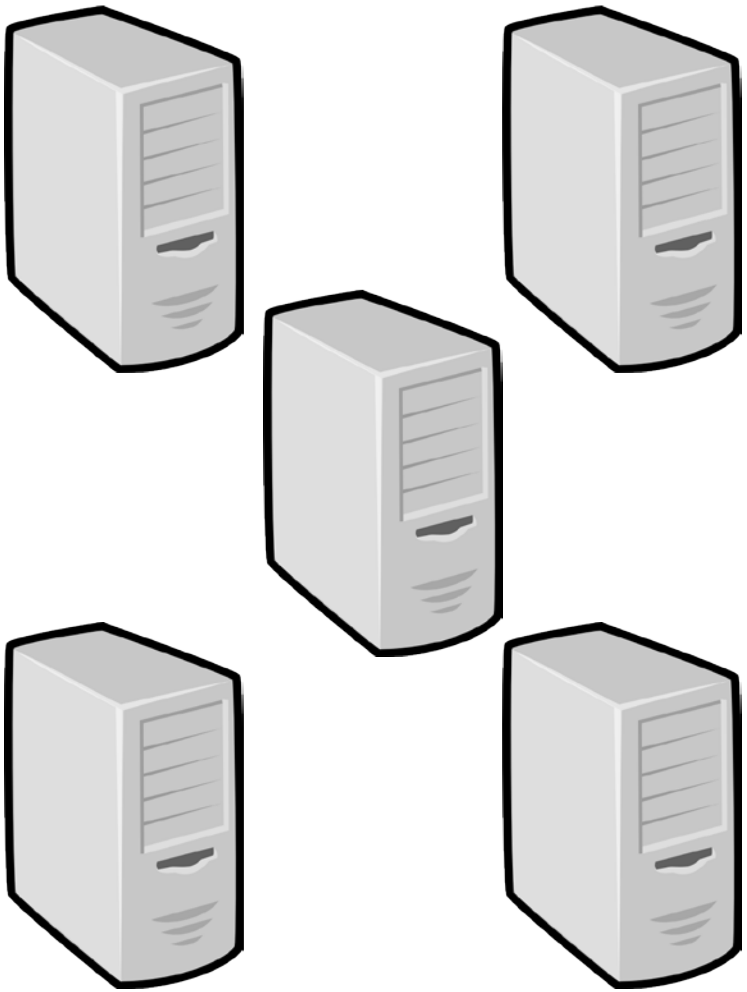
Scaling

- Requests
- Data capacity
- Performance

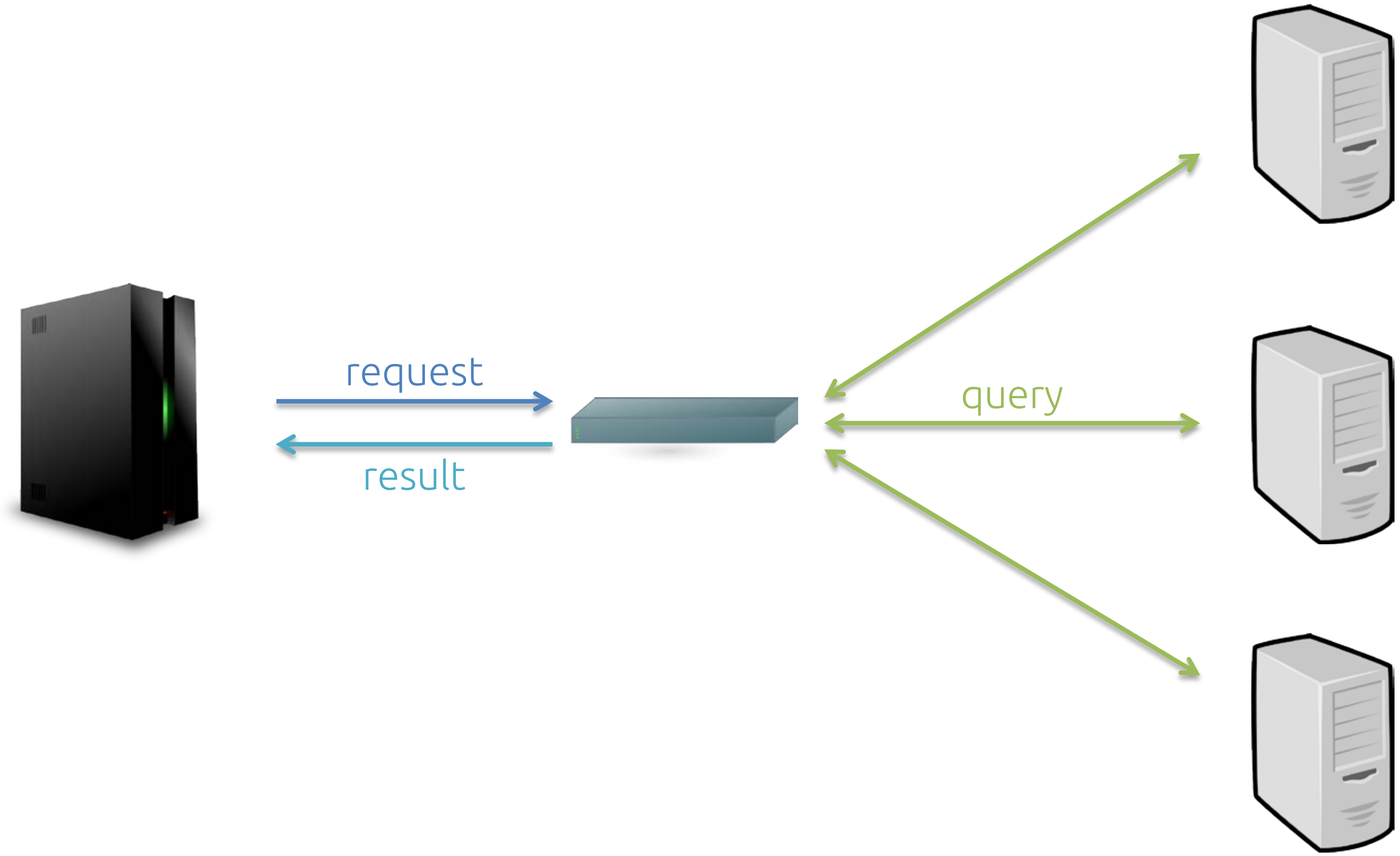


Scaling approaches

vs.

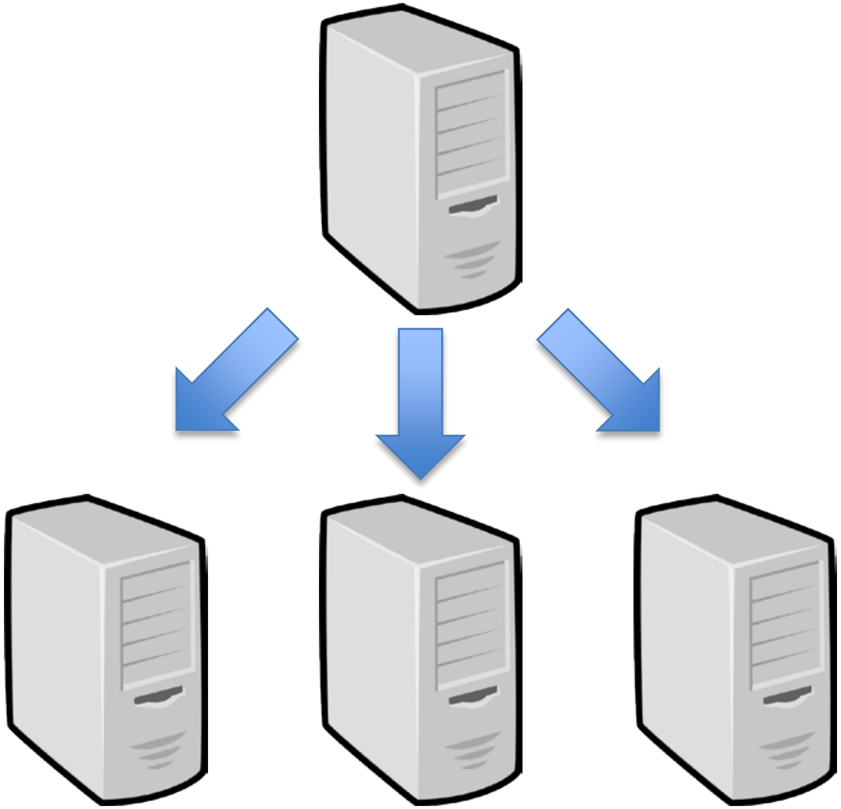


Sharding

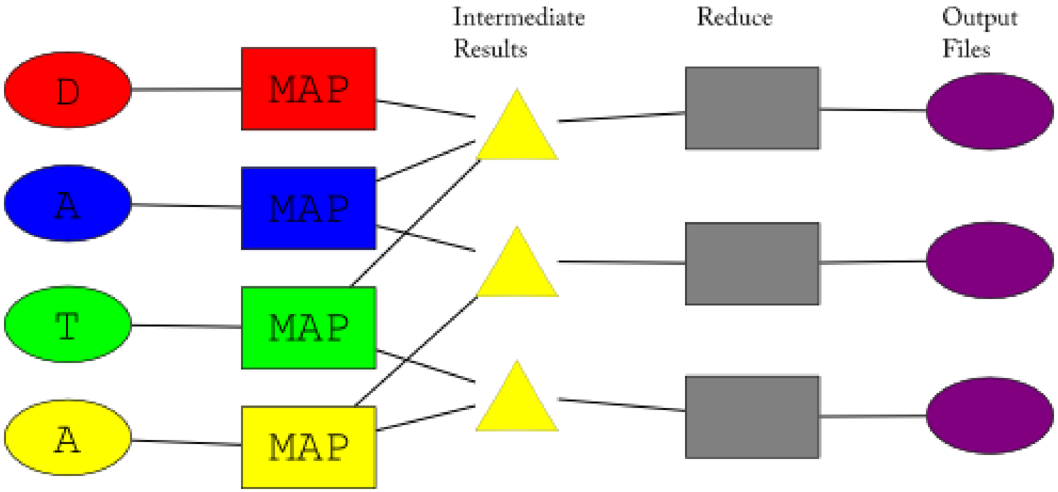


MapReduce

- Huge amounts of data
- Parallel computing
- Distribution
- Efficiency



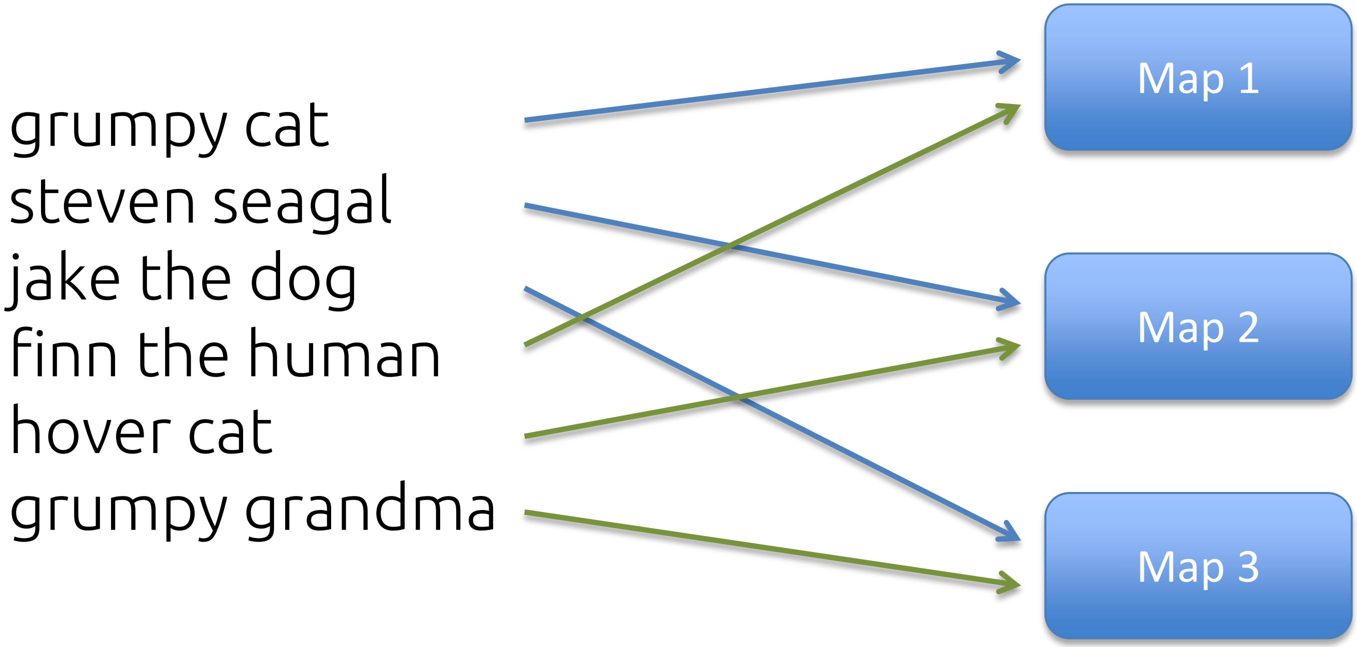
MapReduce


Intermediate Results
Reduce
Output Files
D
MAP
A
MAP
T
MAP
A
MAP

Example – word count

grumpy cat
steven seagal
jake the dog
finn the human
hover cat
grumpy grandma

Map phase



grumpy cat
steven seagal
jake the dog
finn the human
hover cat
grumpy grandma

Map 1

Map 2

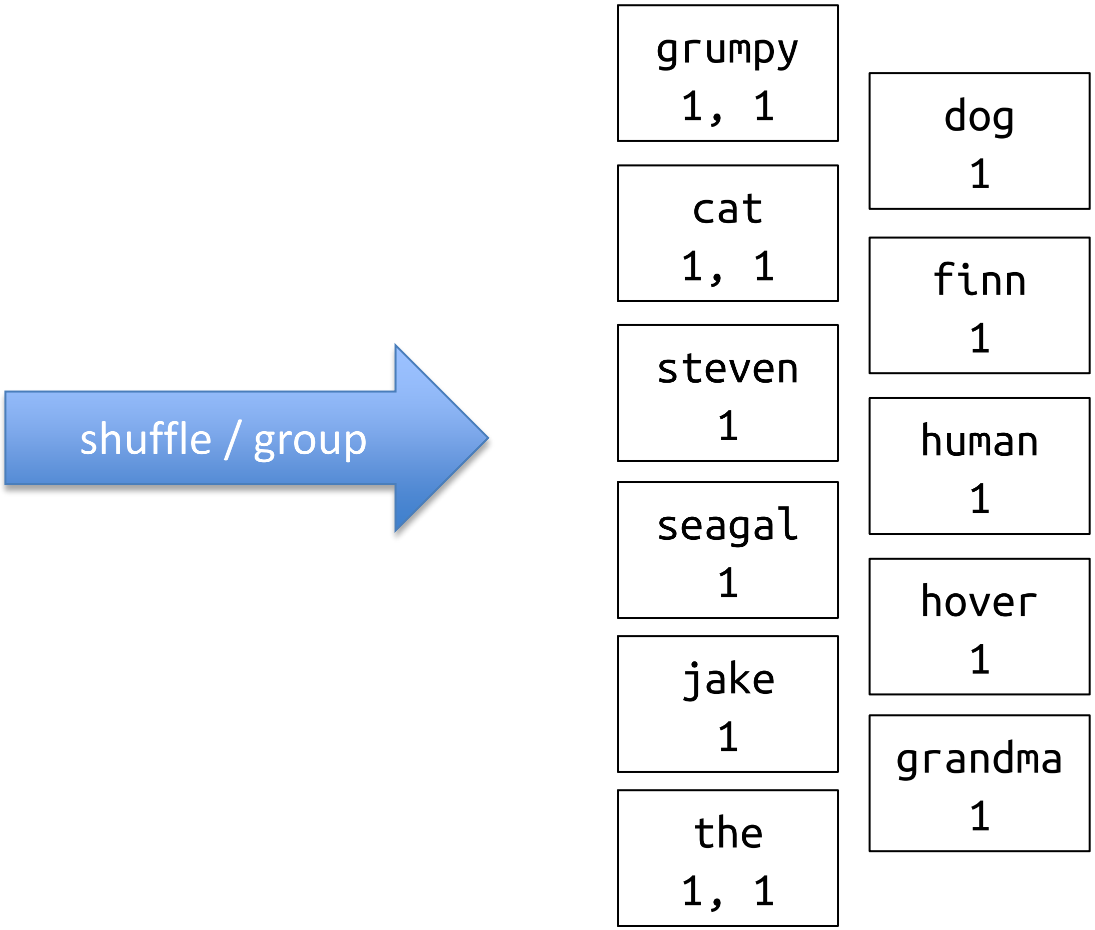
Map 3

Map function

```
function map(line) {
   line.split(“ ”).forEach(function (word) {
      emit(word, 1);
   });
}
```

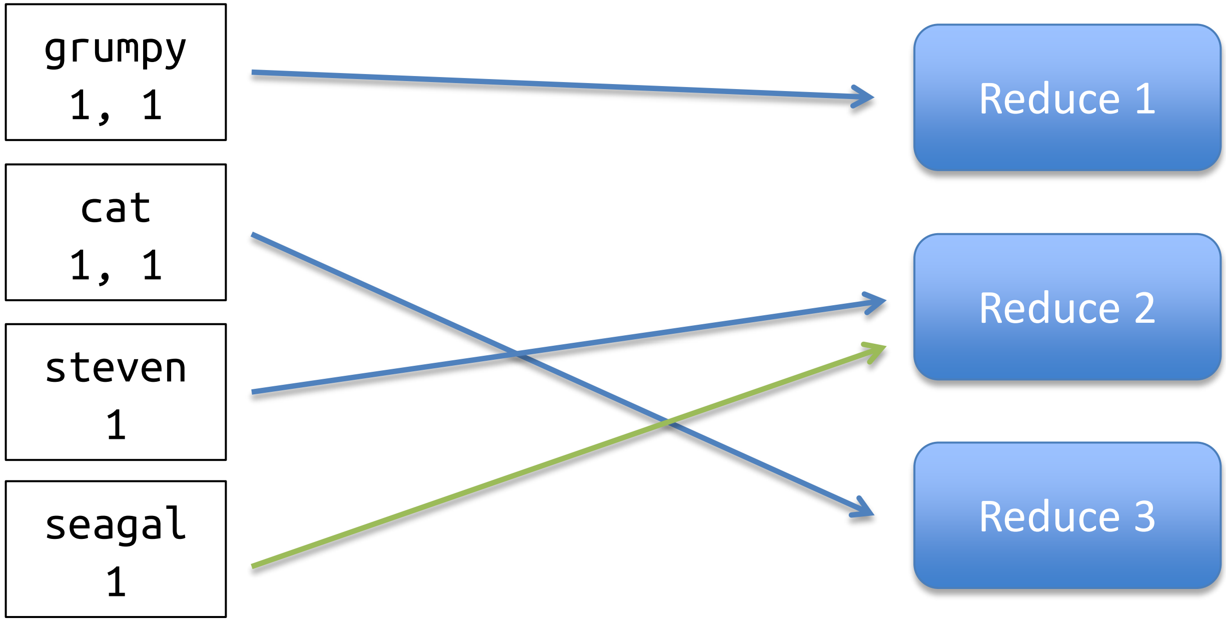
Map output

```
grumpy, 1
cat, 1
steven, 1
seagal, 1
jake, 1
the, 1
dog, 1
finn, 1
the, 1
human, 1
hover, 1
cat, 1
grumpy, 1
grandma, 1
```



```
grumpy
1, 1

cat
1, 1

steven
1

seagal
1

jake
1

the
1, 1

dog
1

finn
1

human
1

hover
1

grandma
1
```

Reduce phase



Reduce function

```
function reduce(key, values) {
  var sum = 0;
  values.forEach(function (value) {
    sum += value;
  });
  return sum;
}
```

Output

```
grumpy, 2
cat, 2
steven, 1
seagal, 1
jake, 1
the, 2
dog, 1
finn, 1
human, 1
hover, 1
grandma, 1
```

Types of NoSQL

- Core NoSQL
- Soft NoSQL
  - Object
  - Grid & Cloud
  - XML
  - Multidimensional
  - Multivalue

Key/Value stores

- Simple model
- Access by key
- Limited queries
- Low latency
- Record independence

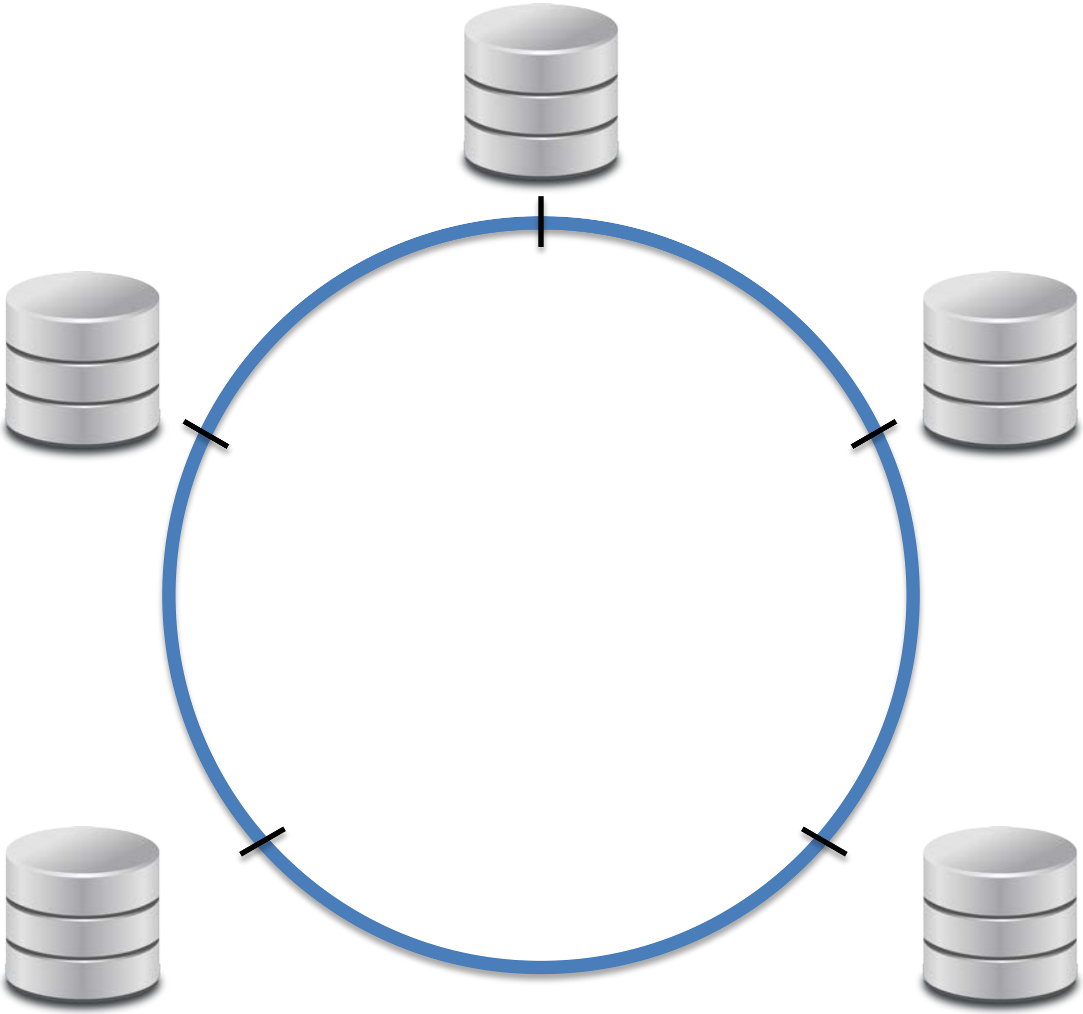
KVS – Data types

- Primitives
- Lists
- Sets
- Objects
- Dictionaries

KVS – Operations

- GET
- SET
- PUT
- DELETE
- …

KVS – Scaling



KVS – Use

- Caching
- Independent data
- Unique keys
- Scalability

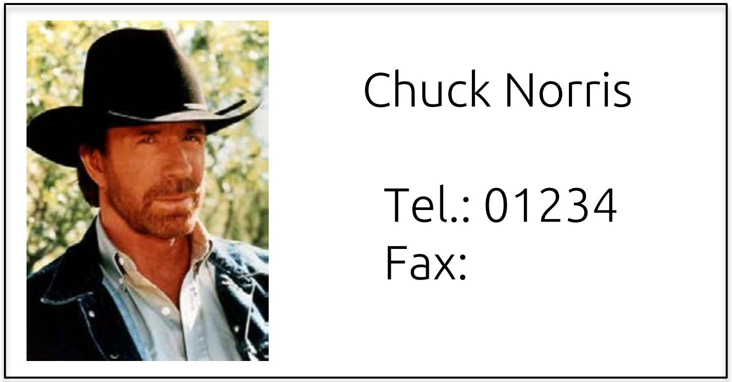
Document stores

- Semi-structured format
- Mostly JSON
- Complex queries
- Flexible schema
- Validation

DS – Data format

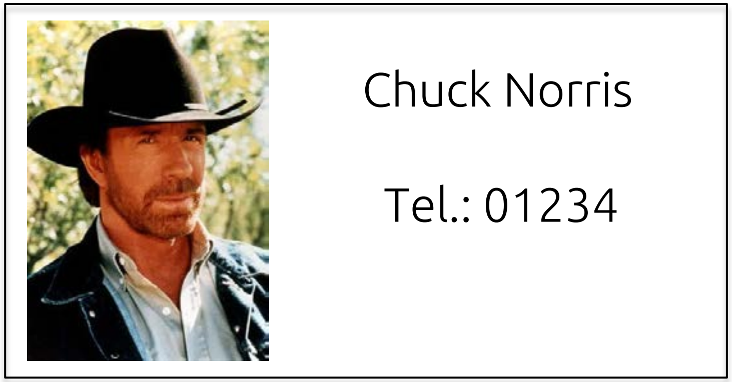
id	name	tel	fax
1	Chuck Norris	01234	null

```
{
        _id: 1,
        name:     “Chuck Norris”,
        tel: 01234
}
```



Chuck Norris

Tel.: 01234
Fax:



Chuck Norris

Tel.: 01234

DS – Features

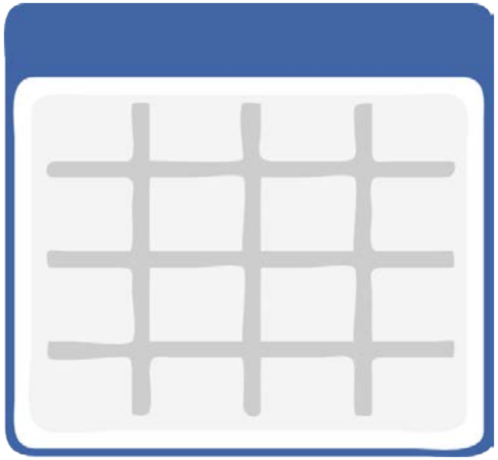
- Replication
  - Master-Slave
  - Master-Master
- Sharding
- Rapid development

DS – Use

- Semi-structured data
- Flexibility
- Querying possibilities
- App-shaped DB
- Integration

Column families

- Data in columns
- Flexible “Rows”
- Column families
- Super columns
- Access by key



CF – Data model

Column Family: Persons	
1	2
“name”: “Chuck Norris”	“name”: “Steven Seagal”
“tel”: 01234	“tel”: 0815
	“fax”: 4711

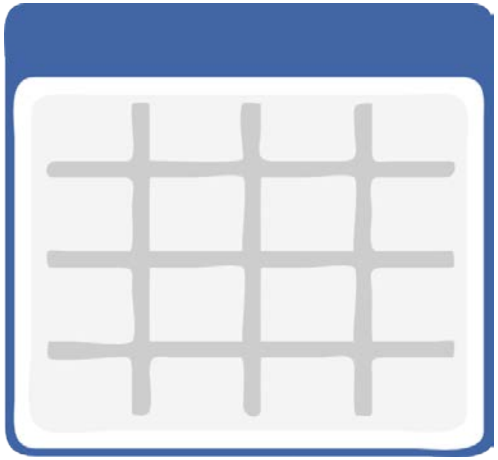
Column Family: Persons		
	1	
		“name”: “Chuck Norris”
		“tel”: 01234
	2	
		“name”: “Steven Seagal”
		“tel”: 0815
		“fax”: 4711

CF – Super columns

Column Family: Movies		
“Nor_Movies”		
	“The Delta Force”	
		“year”: 1986
		“country”: “USA”
	“The Way of the Dragon”	
		“year”: 1972
		“country”: “HK”
“Sea_Movies”		
	“Machete”	
		“year”: 2010
		“country”: “USA”

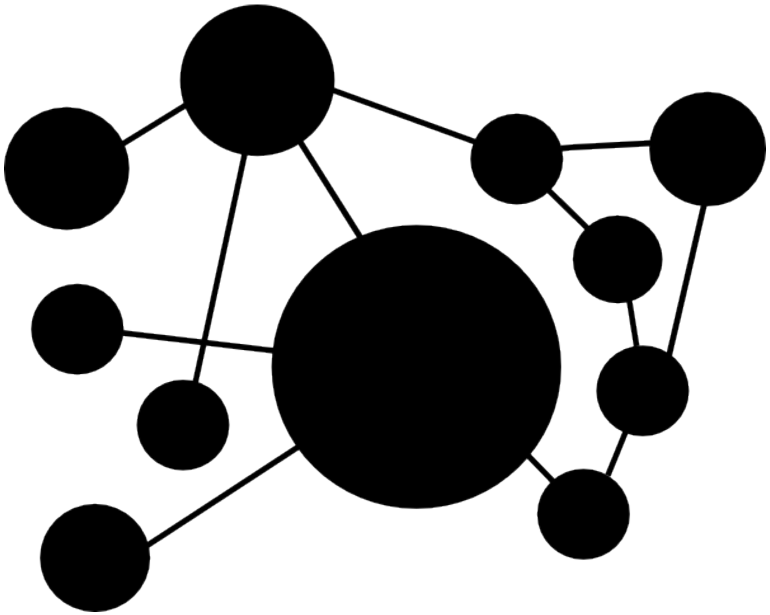
CF – Use

- Flexible data model
- Huge data amount
- Scalability
- Efficiency
- Data analysis

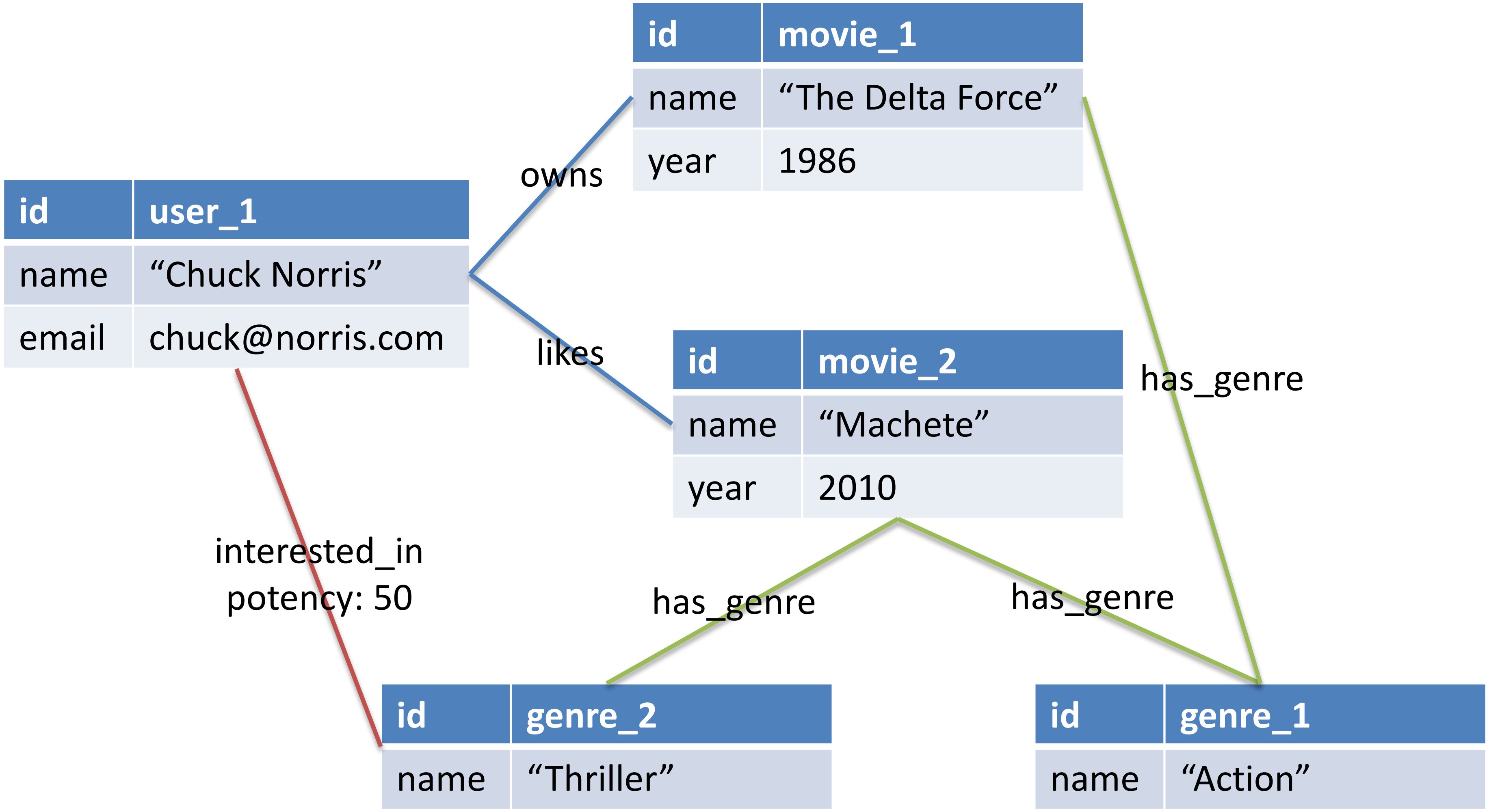


Graph databases

- Interconnected data
- Flexible nodes/edges
- Graph as data model
- Traversing



GD – Data model



id	user_1
name	“Chuck Norris”
email	chuck@norris.com

id	movie_1
name	“The Delta Force”
year	1986

id	movie_2
name	“Machete”
year	2010

id	genre_2
name	“Thriller”

id	genre_1
name	“Action”

owns

likes

has_genre

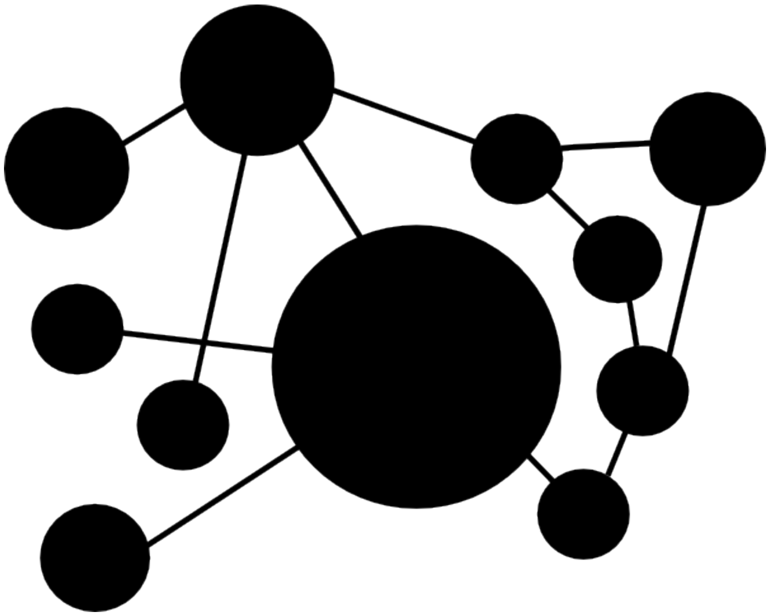
interested_in
potency: 50

has_genre

has_genre

GD – Use

- Interconnected data
- Graphs and trees
- Scientific data
- Traversing desirable



RDMS – doomed to die?

- Maturity
- Transactions
- Querying capabilities
- Knowledge
- Jack-of-all-trades schemas
- Performance

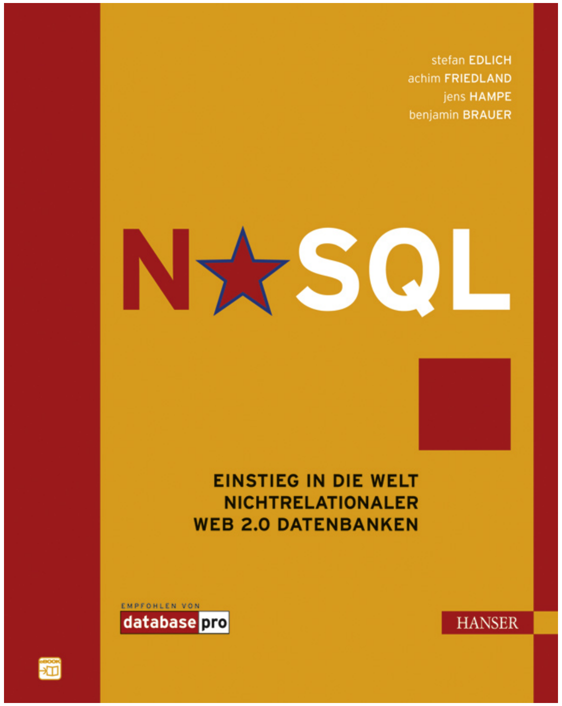
Drawbacks of NoSQL

- Querying capabilities
- Limited features
- Maturity
- Many different systems
- Interchangeability

Reading

NoSQL –
Einstieg in die Welt nichtrelationaler
Web 2.0 Datenbanken

S. Edlich, A. Friedland, J. Hampe, B. Brauer
2010
2nd Edition (2011)
Hanser, ISBN: 978-3-446-42753-2



Reading

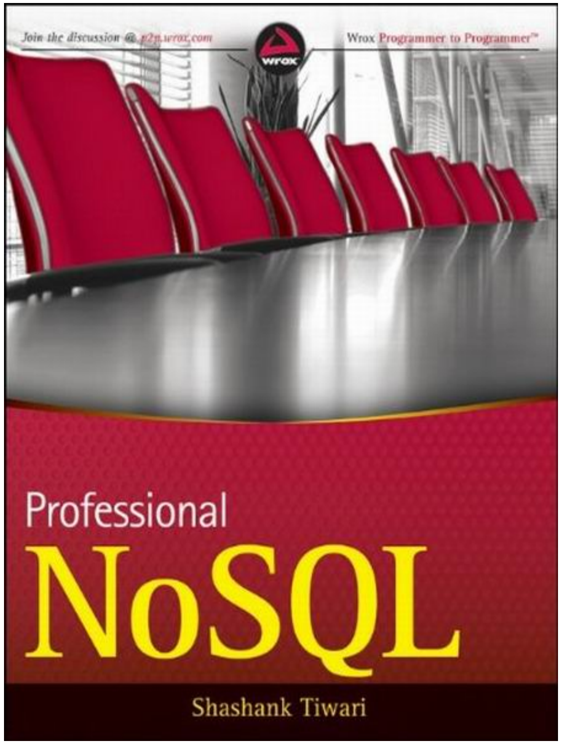
Professional NoSQL

S. Tiwari

2011

Wrox, ISBN: 978-1-4571-0685-9

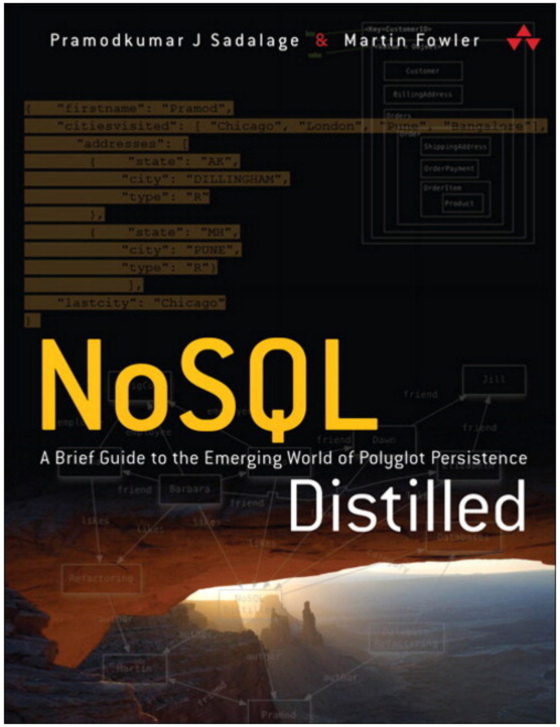
http://it-ebooks.info/book/812/


Join the discussion @ p2p.wrox.com
wrox
Wrox Programmer to Programmer™
Professional
NoSQL
Shashank Tiwari

Reading

NoSQL Distilled

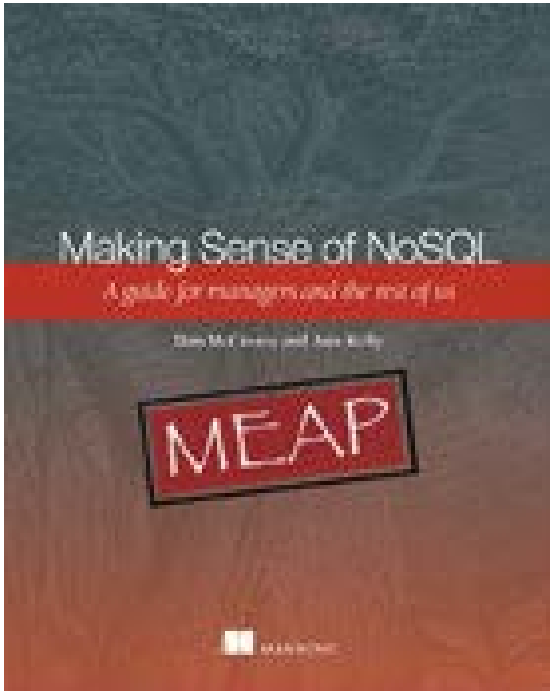
P. J. Sadalage, M. Fowler
2012
Addison-Wesley, ISBN: 978-0321826626


Pramodkumar J Sadalage & Martin Fowler
NoSQL
A Brief Guide to the Emerging World of Polyglot Persistence
Distilled

Reading

Making sense of NoSQL

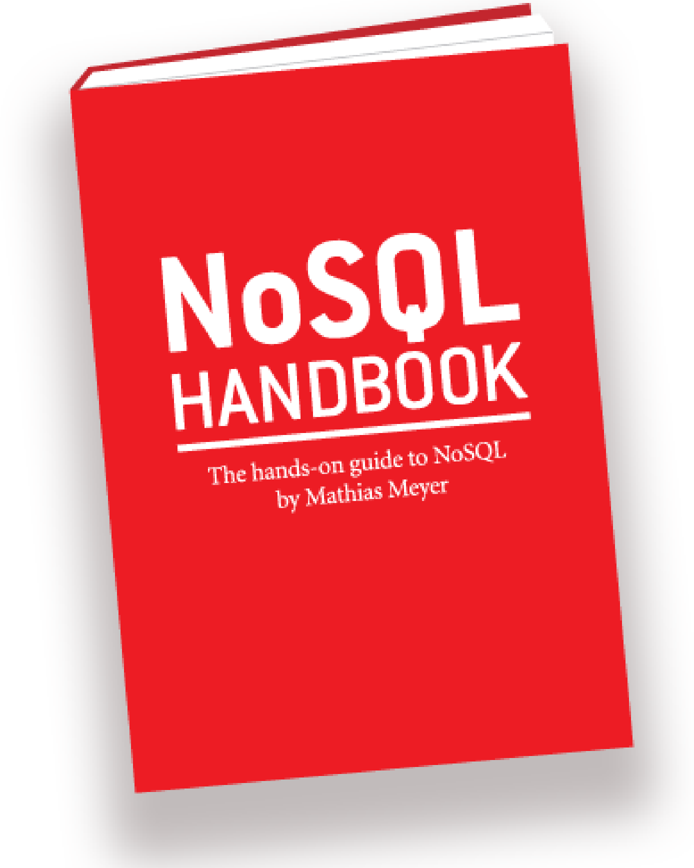
D. McCreary, A. Kelly
August 2013 (est.)
Manning, ISBN: 9781617291074


Making Sense of NoSQL
A guide for managers and the rest of us
Dan McCreary and Ann Kelly
MEAP
MANNING

Reading

NoSQL Handbook

M. Mayer
(not fixed yet)
http://nosqlhandbook.com/



Questions

MongoDB

- Multi-Platform
- Databases
- Collections
- Relationships
- File store
- Drivers

MongoDB – Specs

- Doc size 16MB
- Master-Slave
- Autosharding
- Indexes
- Queries on contents

MongoDB – Data types

- BSON
- String, Array, Bool, Number
- Date / Timestamp
- RegEx
- Code
- Document