# An Introduction to

mongoDB

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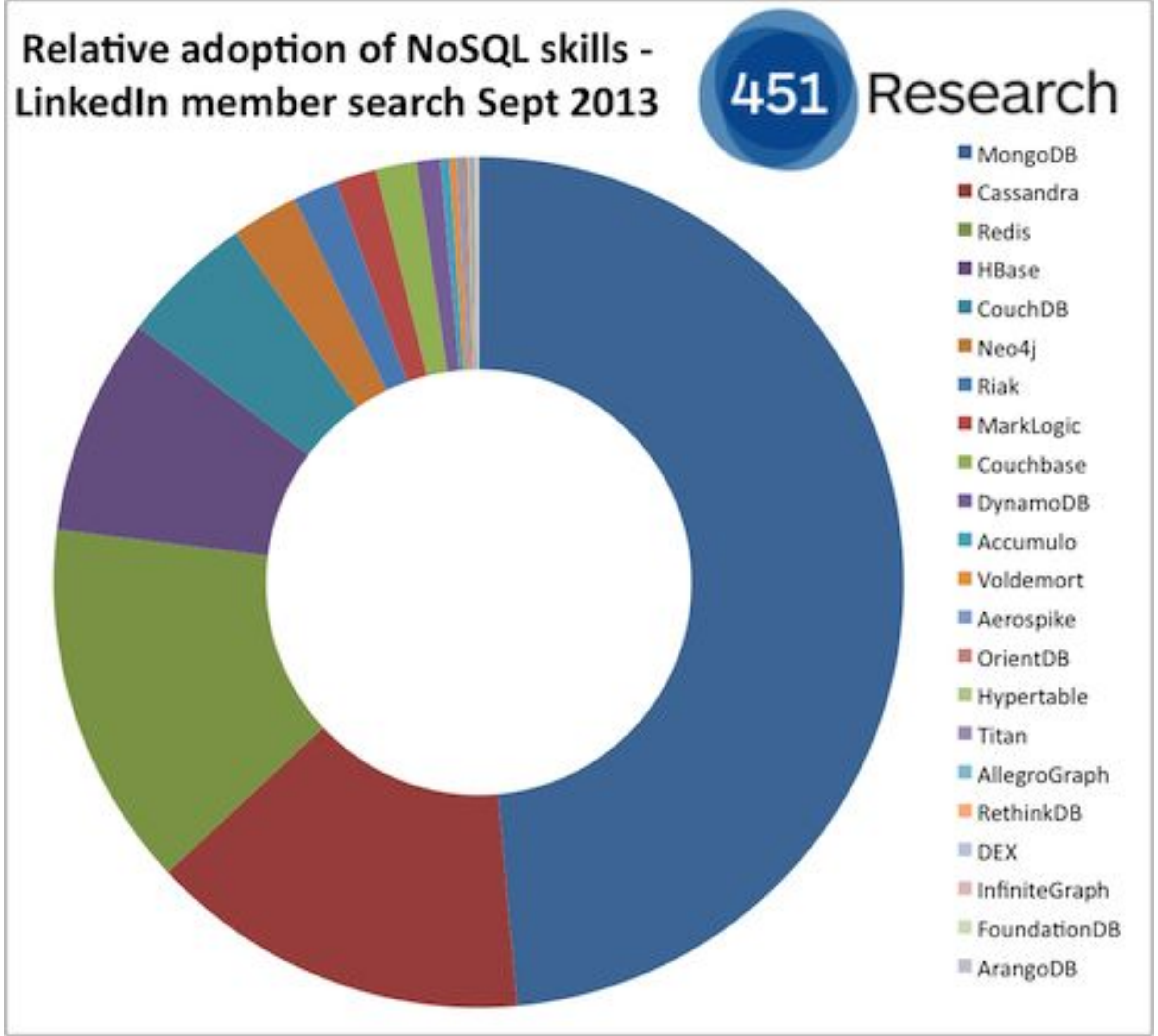
# Database Popularity

| Rank | Name | Score |
|---|---|---|
| 1. | Oracle | 1617.19 |
| 2. | MySql | 1254.27 |
| 3. | SQL Server | 1234.46 |
| 4. | PostgreSQL | 190.83 |
| 5. | DB2 | 165.9 |
| 6. | MongoDB | 161.87 |
| 7. | Microsoft Access | 141.6 |
| 8. | SQLite | 78.78 |
| 9. | Sybase | 77.75 |

http://db-engines.com/en/ranking

Relative adoption of NoSQL skills - LinkedIn member search Sept 2013



## History

- 2004 - Google BigTable Paper
    - NoSql becomes mainstream technology
    - Kicks off movement to create “web scale” databases

- 2007 - 10Gen releases MongoDB
    - Bridges gap between key-values and RDBMS

- 2009 - Open Sourced - GitHub

## Support

- 10Gen -> MongoDB Company
  - Sells enterprise version
    - Security and backup tools
    - Training
    - Integration
    - Support
  - Just raised $150,000,000
  - Documention - MongoDB.org

## Drivers

- JavaScript
- Python
- Ruby
- PHP
- Perl
- Java
- Scala
- C#
- C
- C++
- Haskell
- Erlang

**Plus numerous 3rd party tools and libraries!**

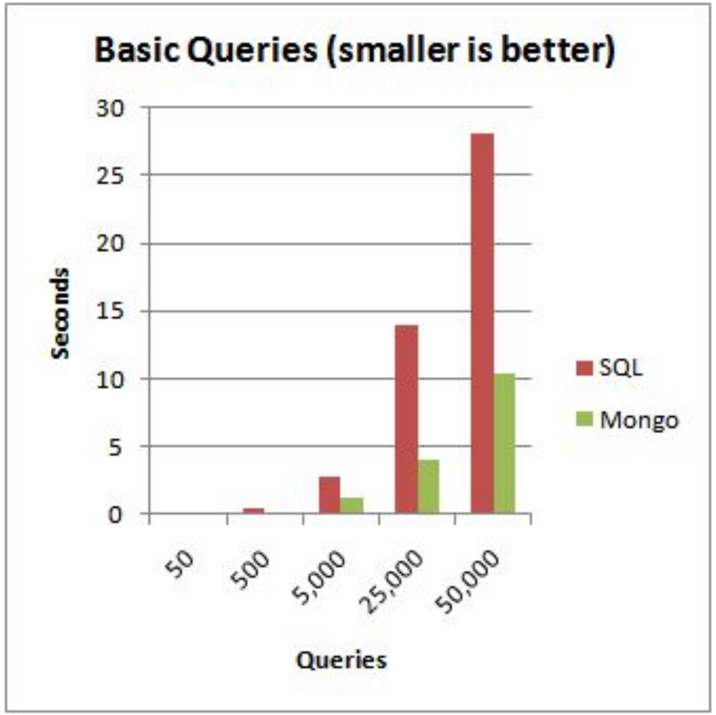
## Major Deployments

- Groupon
- Craigslist
- Bit.ly
- eBay
- eHarmony
- Answers.com (St. Louis)
- CarFax (St. Louis)

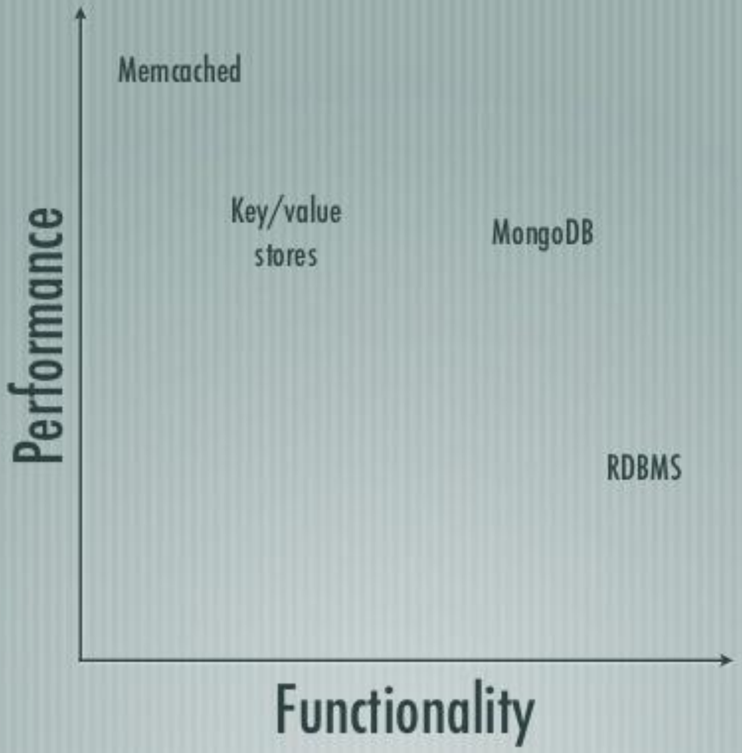
## Primary Benefits

- Speed Speed Speed!
- Rich Dynamic Queries
- Lazy Creation
- Schema-less
- Returns JSON
- Easy Replication and Failover
- Auto-Sharding
- MapReduce

# How Fast?



Basic Queries (smaller is better)
30
25
20
15
10
5
0
Seconds
50
500
5,000
25,000
50,000
Queries
SQL
Mongo


Memcached
Key/value stores
MongoDB
RDBMS
Performance
Functionality

## A BSON (binary JSON) document

```
{
        "_id" : ObjectId("52832eb59f36fe144eeea8dc"),
        "baseprice" : 8.99,
        "category" : "toys",
        "colors" : [ "red", "green", "cosmic purple"],
        "name" : "Cosmic Yo-yo",
        "promotions" : [
                        { "coupon" : "XY678", "saleprice" : 7.99, "expires" : ISODate("2013-12-12T00:00:00Z") },
                        { "coupon" : "AB8888", "saleprice" : 7.49, "expires" : ISODate("2014-01-01T00:00:00Z") }
                      ]
}
```

# Terminology

Database -> Database

Table -> Collection

Record / Row -> Document

Field -> Field

## find()

```
db.products.findOne()
db.products.find()
db.products.find().pretty()
db.products.find({ _id : ObjectId("52832eb59f36fe144eeea8dc") })
db.products.find({ name : "Cosmic Yo-yo" })
db.products.find({ name : /^hack/i }).pretty()
```

Index fields used for find!

## Projections

```
db.products.find({ "name" : "Hacky Sack Maxx" },{  baseprice : 1 } )
db.products.find({ "name": "Hacky Sack Maxx" },{  baseprice: 1, category : 1 } )
db.products.find( { }, {  promotions : 1 } )
db.products.find( { }, {  promotions : 1 } )[0].promotions
```

## Ids

ObjectId is a 12-byte BSON type, constructed using:

- a 4-byte value representing the seconds since the Unix epoch,
- a 3-byte machine identifier,
- a 2-byte process id, and
- a 3-byte counter, starting with a random value
- Show with .getTimestamp()

## Shell

Runs native JavaScript

- Google V8
- Can run native functions, but not recommended in production

## Queries

```
db.products.find().sort( { baseprice : -1
}).pretty()
db.products.find().limit(1).pretty()
db.products.find().limit(1).skip(1).pretty()
```

## Conditions

```
db.products.find({ baseprice : { $gt : 4.99 }})
db.products.find({ baseprice : { $lte : 4.99 }})
db.products.find({ promotions : { $lte : 4.99 }})
db.products.find( { colors : { $in :  ["red"] }})
db.products.find( { "promotions.coupon" : { $in :  [  "XY678"
] }}).pretty()
db.products.find({ $and : [{ category : "toys"},{ baseprice : {
$gt : 4.99 }}]}
```

## Other Queries

```
db.products.count()
db.products.find({ baseprice : { $gt : 2.99 }}).count()
db.products.insert({ name : "Juggle-O-rama", baseprice : 11.99 })
db.products.update({ name : "Juggle-O-rama" }, { $set : { category : "toys" }})
db.products.update({ name: “Juggle-O-rama” }, { $set : {  colors : ["silver",
"gold"]}})
db.products.update({ name: "Juggle-O-rama" }, { $push : {  colors : "sea foam
green"}})
```

**Don’t forget $set!**

## Aggregation

db.products.aggregate({ $group : { _id : "$category", totalprice : { $sum : "$baseprice" }}})

## Indexes

- Single
- Compound
- Nested Elements
- In Array
- Whole Document!

```
db.products.ensureIndex({ name : 1})
```

# Geospatial Indexes

```
{
        _id : ObjectId(...),
        name : "Brad Urani",
        addresses : [
                    { context : "home" , loc : [ 55.5, 42.3 ] },
                    { context : "office",  loc : [ -74 , 44.74 ] }
                ]
}
```

Can Query

- Within Certain Distance
- Within Polygons
- Where Polygons Intersect
- Others

# Temporary Records

- Time to Live (TTL)
  - `db.log.events.ensureIndex( { "status": 1 }, { expireAfterSeconds: 3600 } )`
- Capped Collections
  - Set a maximum number of records in the collection
  - Provides very fast writing

## Primary Benefits

- Speed Speed Speed!
- Rich Dynamic Queries
- Lazy Creation
- Flexible Schema
- Returns JSON
- Easy Replication and Failover
- Auto-Sharding
- MapReduce

## Lazy Creation

Lazy Creation Saves Developer Time

- Instant Set-up
- No Change Scripts
- Easier Data Migration
- Great for Data Warehousing

## Flexible Schemas

- I.E. Different data for different for different product types
- Flexible nesting rules
- Simplifies Internationalization
- Easy Custom Fields

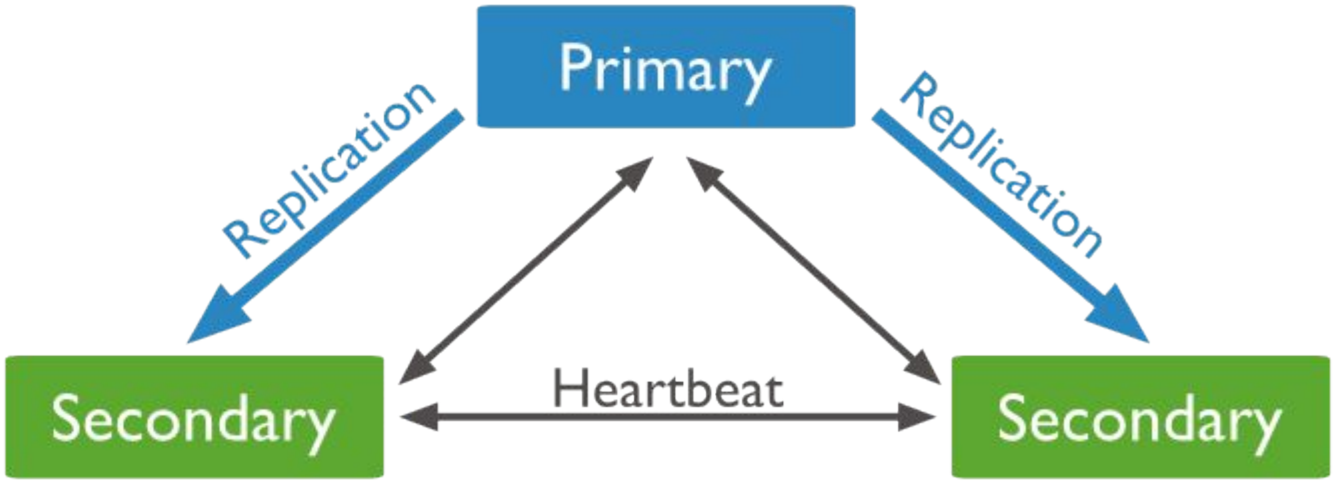
# JSON Front-to-Back!

Queries return JSON

- Dirt simple APIs
- No Data Manipulation Needed
- Ditch the ORM
- Easy JavaScript Integration
- Fits perfectly with KnockoutJS, AngularJS etc.

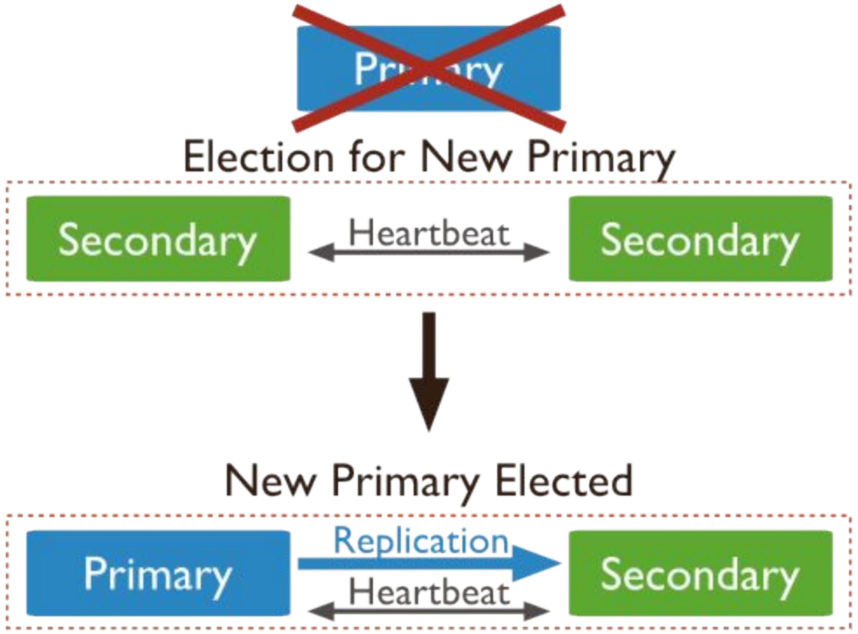
# Replica Sets

Master / Slave

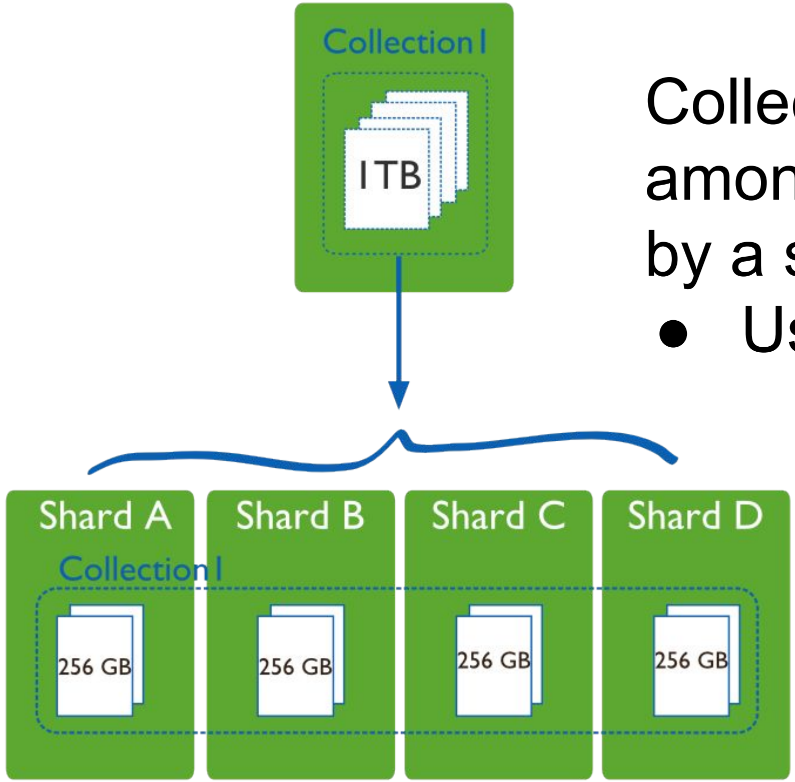


# Replica Set Election

If a primary fails, the secondaries automatically elect a new primary



## Sharding



Collections are split amongst multiple servers by a shard key

- Used to scale writes

## Limitations

- No Transactions
- No Joins
- RAM intensive
- No referential integrity
- Eventual Consistency

## Design Considerations

Embed vs. Reference

- Instead of joining junction tables, embed subdocuments in documents
- 90% of the time choose embed over reference
- You may have to store the same data twice

# Denormalized Data

```
{
        _id : ObjectId(...),
        Name: “November Specials”,
        Promotions : [
                        { Title: “20% off all Yo-yos”,        Coupon: “AB345” },
                       { Title: “Free shipping on Hacky Sacks”, Coupon : “XY456” }
                       ],
        Dates : [ ISODate(“2013-11-01”), ISODate(“2013-11-31) ]
}, { _id : ObjectId(...),
        Name: “December Specials”,
        Promotions : [
                        { Title: “10% off all frisbees”, Coupon: “BA445” },
                       { Title: “Free overnight shipping on all jump ropes”, Coupon : “XY456” }
```

## Schema Design

SQL: Optimizing how data is stored

MongoDB: Optimize how data is used

SQL: What answers do I have?

MongoDB: What questions do I have?

# Choices

```
{
        OrderId("....")
        Items : [
                        { _id : ObjectId("..."), name : "Cosmic Yo-yo", color : "red", qty : 1 },
                        { _id : ObjectId("..."), name : Hackey Sack Maxx", color : "tiger orange", qty: 2
}
                ]
        Promotions : [
                                { _id : ObjectId("..."), Coupon : "AB456" : 6.99 }
                        ]
}
```

## Use Cases

- Anything with user generated data
  - Social Media
  - CMS
  - Blogs
- Product Data (Ecommerce)
- Games
- Location services
- Logging
  - Clickstream
- Analytics
  - Real-Time
  - Data Warehouses

## Not Great For

Transaction Critical Data

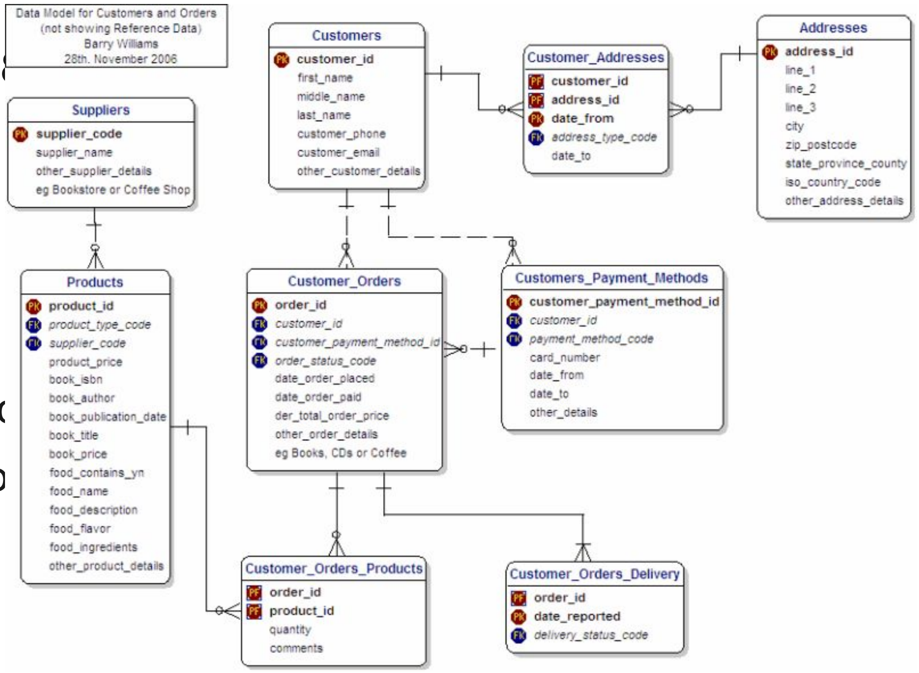
- Purchases
- Banking
- Inventory Control

# Use Both!

**Products in MongoDB**

```
{
        "_id" : ObjectId("52833435add826d9da83926
        "baseprice" : 4.99,
        "category" : "toys",
        "colors" : [ "tiger orange", " canary yellow" ],
        "name" : "Hacky Sack Maxx",
        "promotions" : [ { "coupon" : "ZY678", "salepric
                         { "coupon" : "CD8888", "promo
                    ]
}
```

**Orders in SQL**



# Architect for Scalability

- Databases need to handle peak load, not average load
- Avoid Unnecessary Data Transformations
- Developer productivity is part of scalability

mongoDB

## Contacts

pushup

http://pushup.com

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