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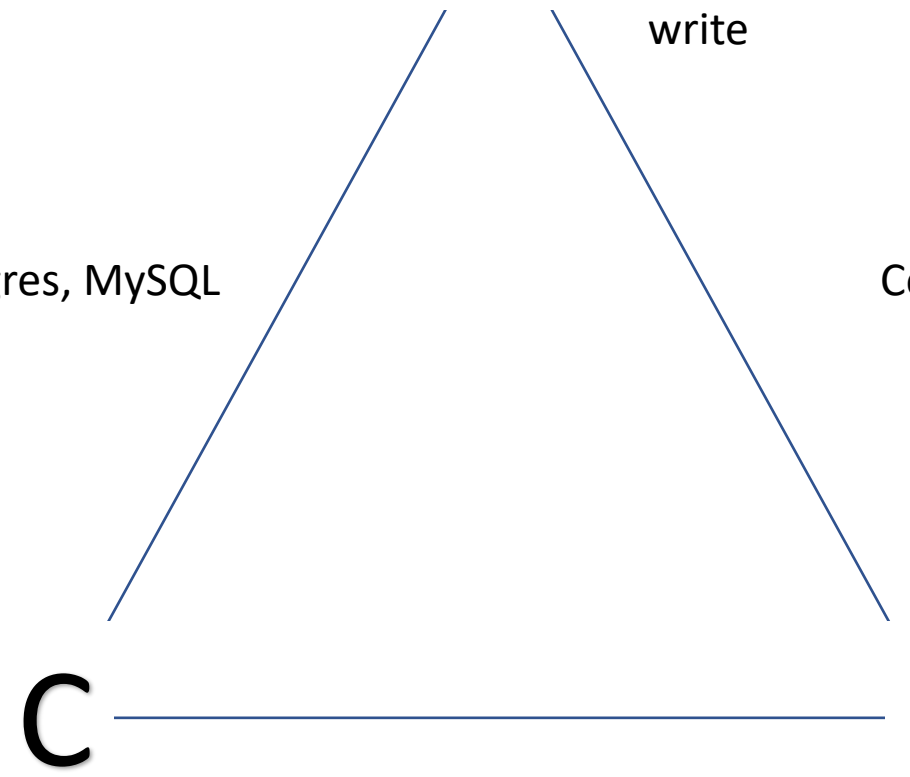
MONGODB

Intro

What is MongoDB

- Developed by 10gen
- Founded in 2007
- A document-oriented, NoSQL database
  - Hash-based, schema-less database
    - No Data Definition Language
    - In practice, this means you can store hashes with any keys and values that you choose
      - Keys are a basic data type but in reality stored as strings
      - Document Identifiers (_id) will be created for each document, field name reserved by system
    - Application tracks the schema and mapping
    - Uses BSON format
      - Based on JSON – B stands for Binary

Where does it fit in CAP Theorem



Availability:
Each client can always read and write

RDBMS, Postgres, MySQL

Couch DB, Cassandra, Dynamo

Consistency: All clients always have the same view of data

Big Table, Hbase, MongoDB, Redis

Partition Tolerance:
Works well despite physical network partitions

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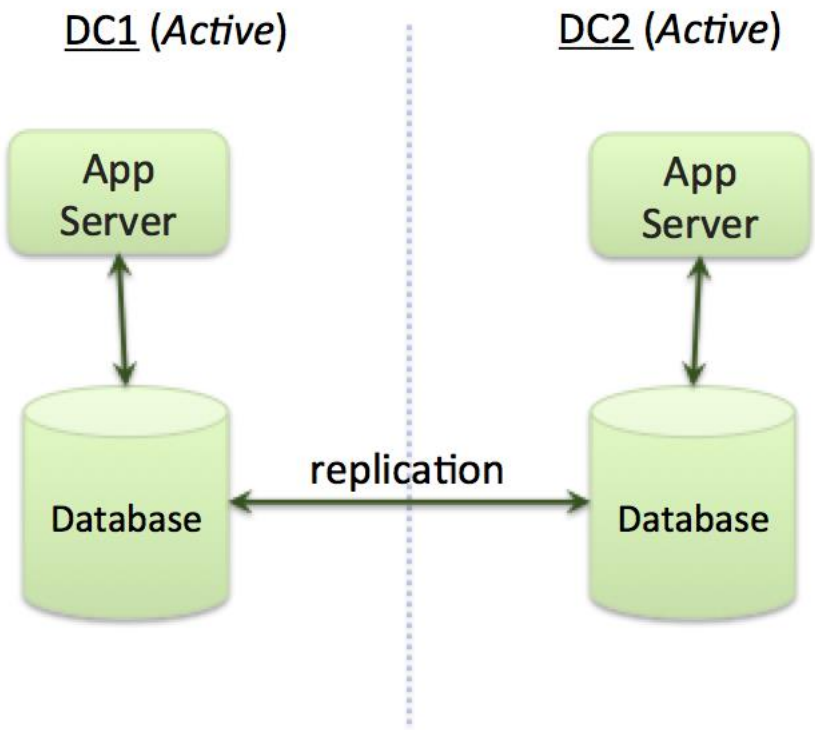
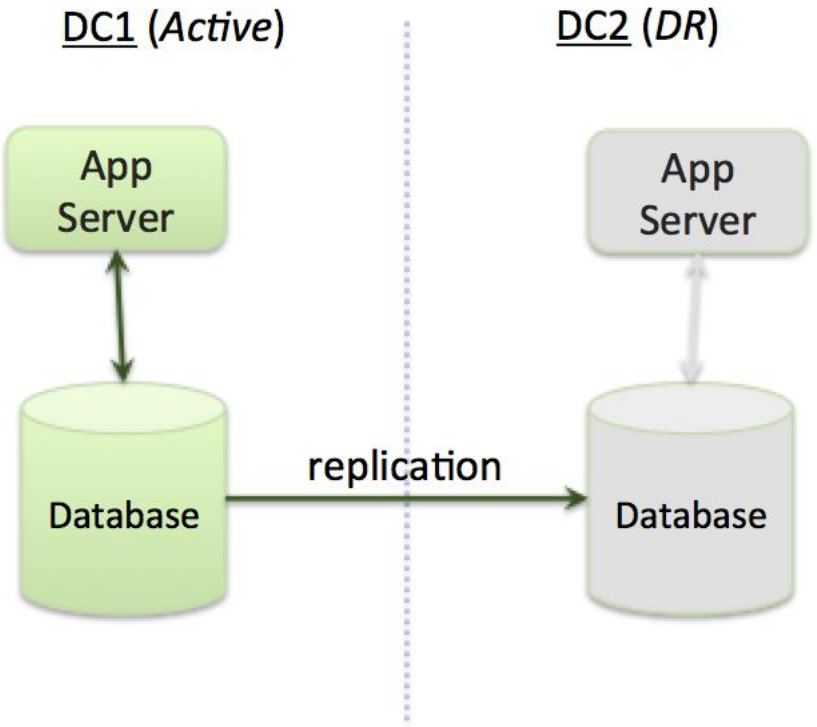
Active Active Architecture

- Serve a globally distributed audience by providing local processing (low latencies)
- Maintain always-on availability, even in the face of complete regional outages
- Provide the best utilization of platform resources by allowing server resources in multiple data centers to be used in parallel to process application requests.



Active DR Architecture

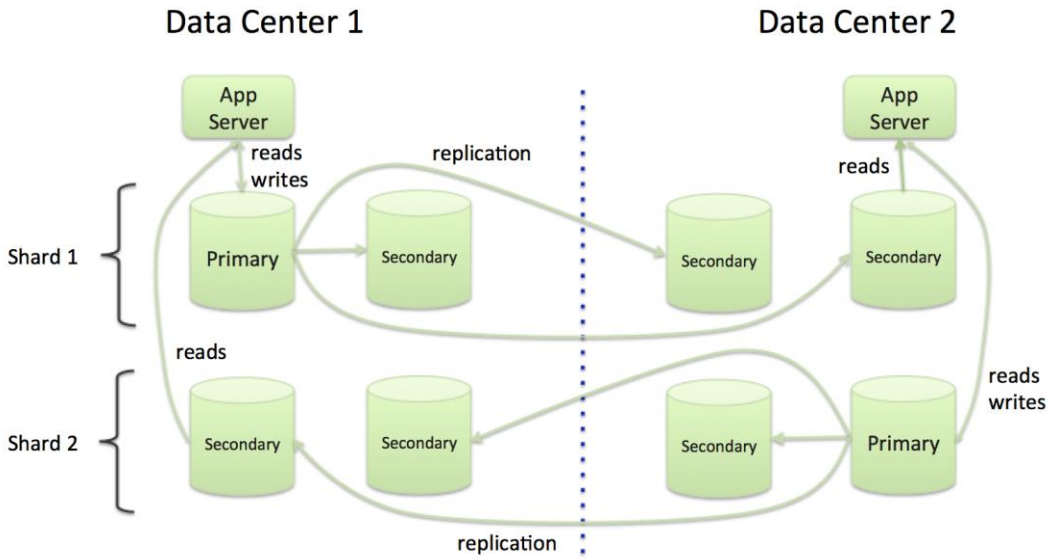
- A simpler architecture to maintain
- Replication copies data from the active node to the DR node
- DR site takes over after failure of the Active node
- More expensive to operate due to idle resources

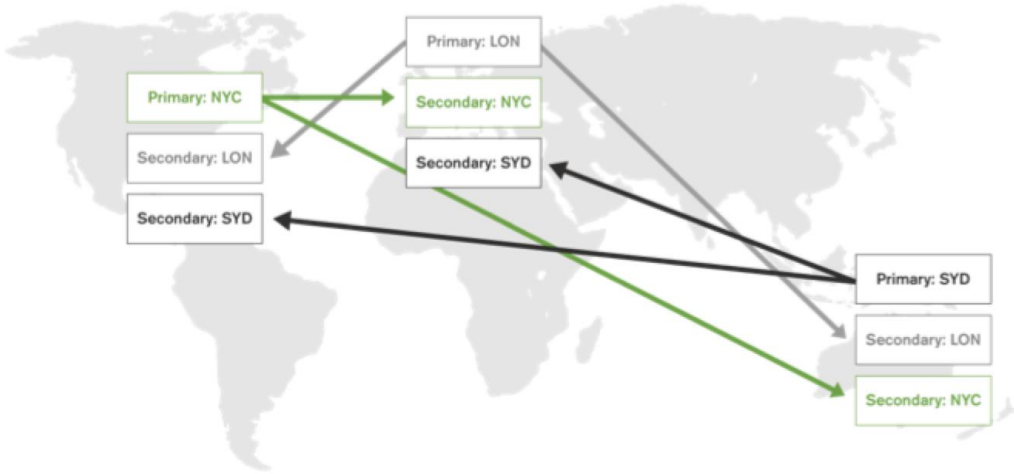


Distributed Architectures

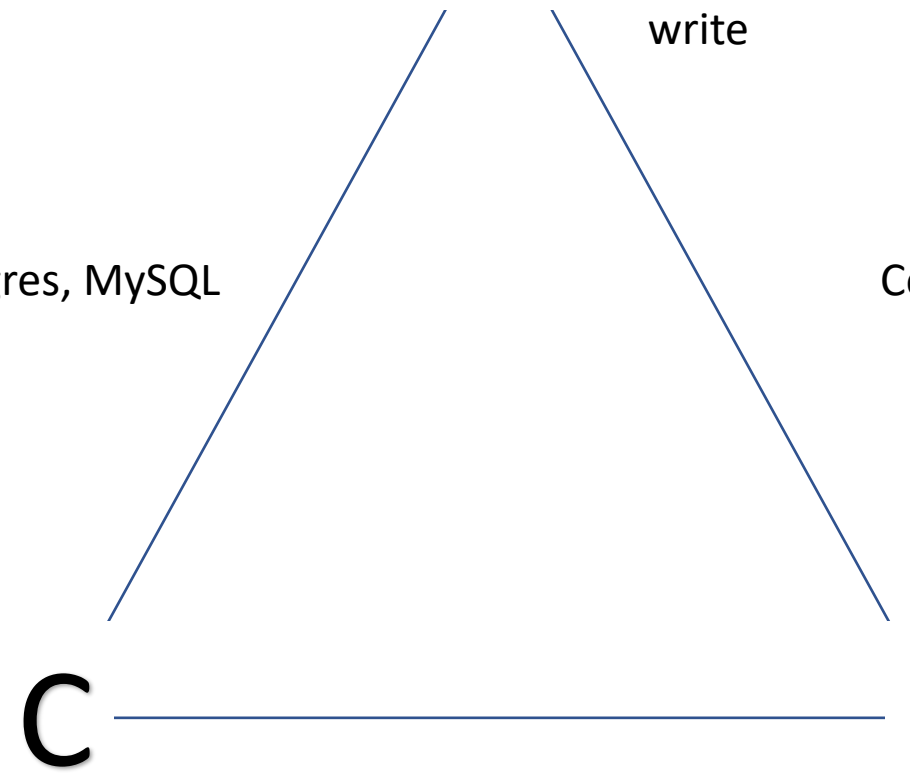
- Distributed transactions using two-phase commit
- Multi-Master, sometimes also called "masterless"
- Partitioned (sharded) database with multiple primaries each responsible for a unique partition of the data

Sharded Architecture





Where does it fit in CAP Theorem



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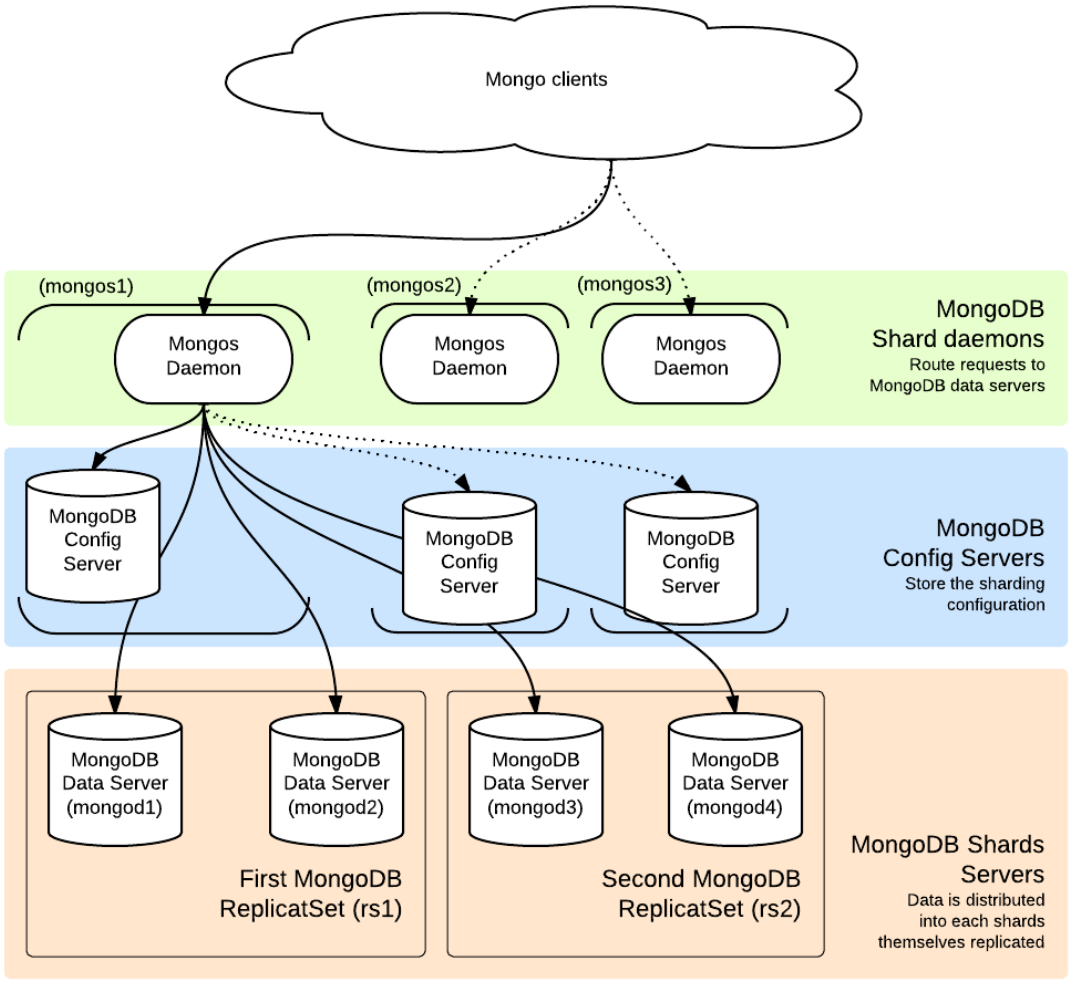
MongoDB Architecture



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Replication

- A replica set is a group of mongod instances that maintain the same data set.
- A replica set contains several data bearing nodes and optionally one arbiter node.
  - Of the data bearing nodes, one and only one member is deemed the primary node, while the other nodes are deemed secondary nodes.
- The primary node receives all write operations.
  - A replica set can have only one primary capable of confirming writes with { w: "majority" } write concern; although in some circumstances, another mongod instance may transiently believe itself to also be primary.
  - Primary is Primary until decided otherwise or fails to reply to heartbeat

Sharding

- *Vertical Scaling* involves increasing the capacity of a single server, such as using a more powerful CPU, adding more RAM, or increasing the amount of storage space. Limitations in available technology may restrict a single machine from being sufficiently powerful for a given workload. Additionally, Cloud-based providers have hard ceilings based on available hardware configurations. As a result, there is a practical maximum for vertical scaling.
- *Horizontal Scaling* involves dividing the system dataset and load over multiple servers, adding additional servers to increase capacity as required. While the overall speed or capacity of a single machine may not be high, each machine handles a subset of the overall workload, potentially providing better efficiency than a single high-speed high-capacity server. Expanding the capacity of the deployment only requires adding additional servers as needed, which can be a lower overall cost than high-end hardware for a single machine. The trade off is increased complexity in infrastructure and maintenance for the deployment.

Structure

- **The database :** In simple words it can be called as the physical container for data.
- **The Collection :** A group of database documents can be called as a collection.
- **The Document :** A set of key-value pairs can be designated as a document.

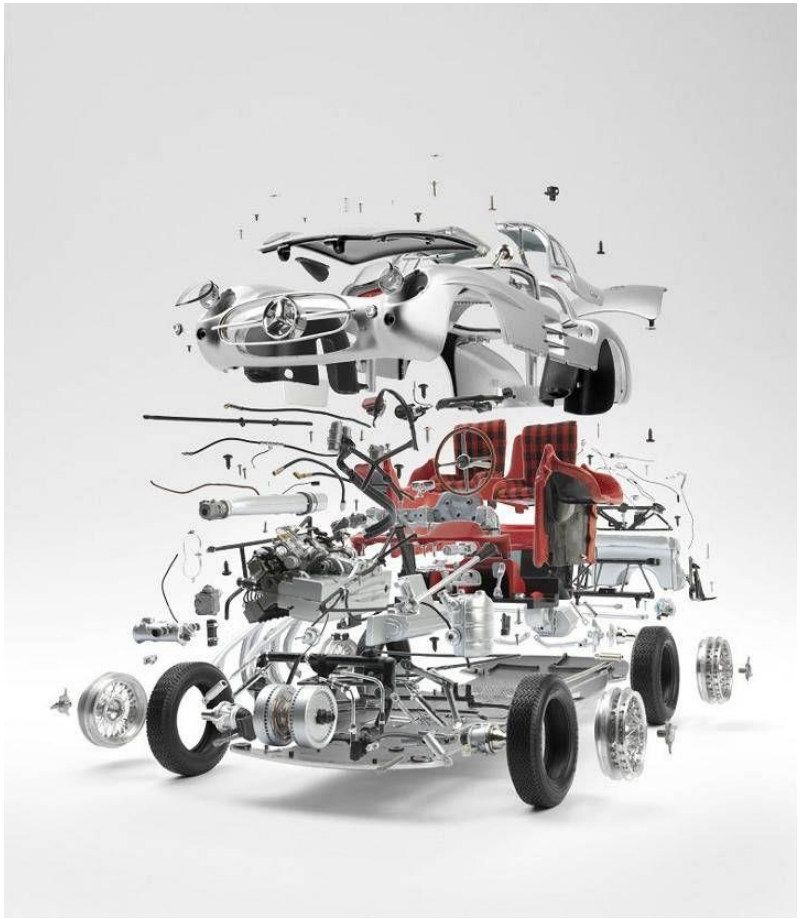
Data Model

- Stores data in form of BSON (binary JavaScript Object Notation) documents

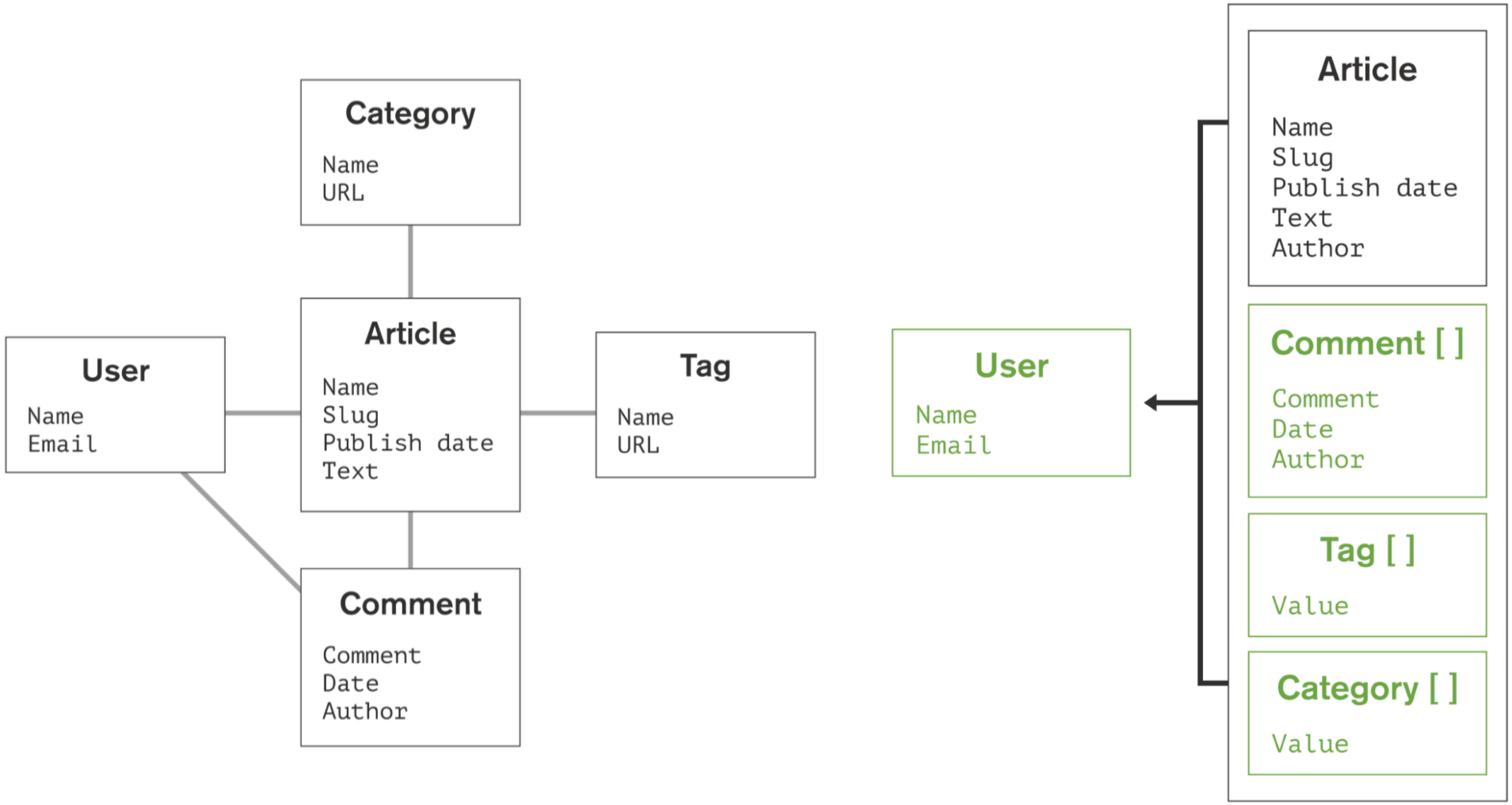
```
{       name: “Ray Ready”,
        salary: 30000,
        designation: “Adjunct Professor”,
        courses: [ “database”,  “database 2”, “data warehousing” ]
}
```

- Group of related documents with a shared common index is a collection

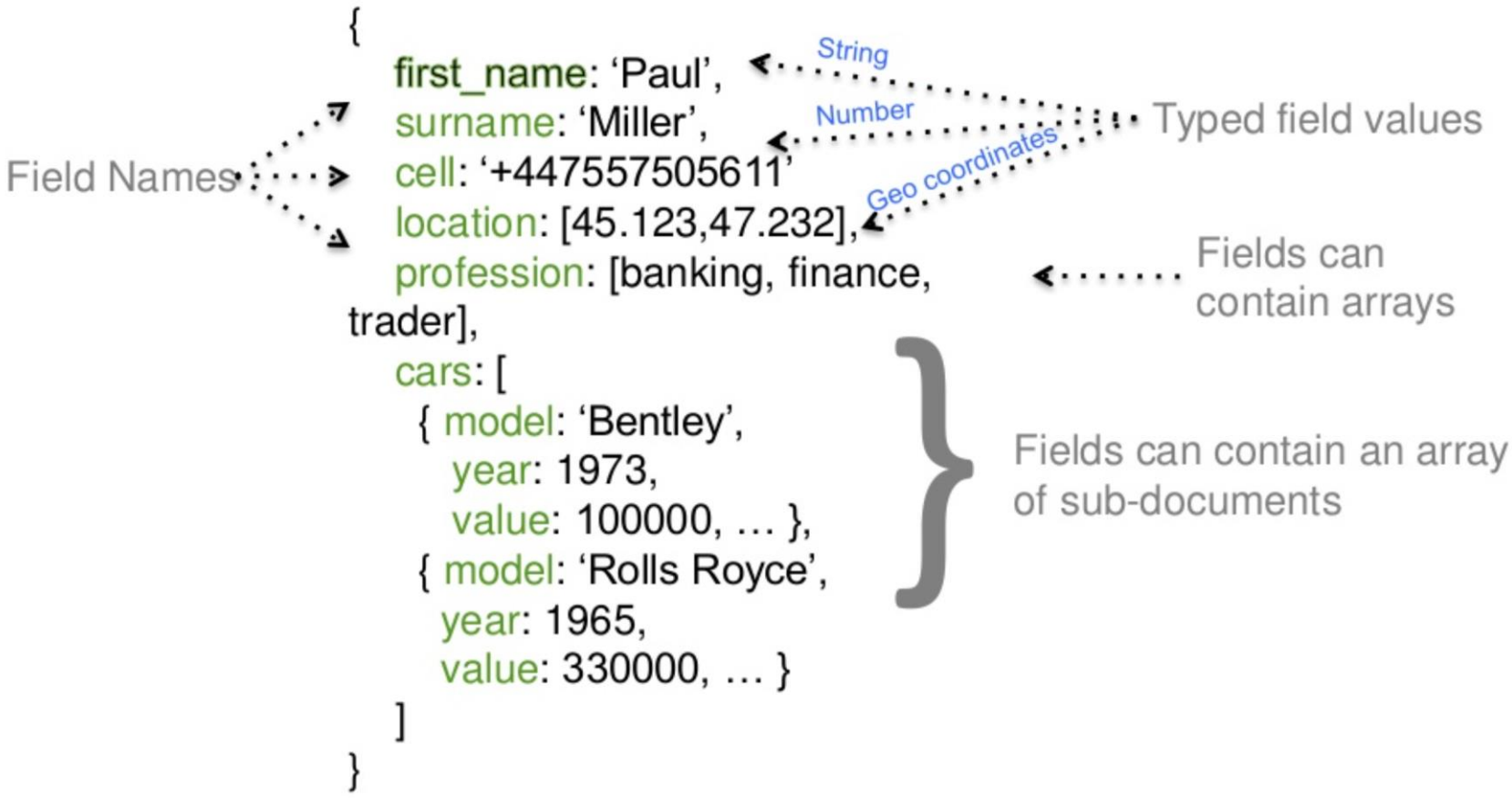
RDBMS vs Document/Object Model



Example Relational to Mongo



Natural Model



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Data Types

Type	Description	Number
Double	Represents a float value.	1
String	BSON strings are UTF-8. In general, drivers for each programming language convert from the language's string format to UTF-8 when serializing and deserializing BSON. This makes it possible to store most international characters in BSON strings with ease. [1] In addition, MongoDB $regex queries support UTF-8 in the regex string.	2
Object	Represents an embedded documents.	3
Array	Sets or lists of values can be represented as arrays:	4
Binary data	Binary data is a string of arbitrary bytes, it cannot be manipulated from the shell.	5
Object id	ObjectIds (MongoDB document identifier, equivalent to a Primary key) are: small, likely unique, fast to generate, and ordered. These values consists of 12-bytes, where the first four bytes are a timestamp that reflect the ObjectId's creation.	7
Boolean	A logical true or false. Use to evaluate whether a condition is true or false	8
Date	BSON Date is a 64-bit integer that represents the number of milliseconds since the Unix epoch (Jan 1, 1970). This results in a representable date range of about 290 million years into the past and future.	9
Null	It represents both a null value and a nonexistent field.	10
Regular Expression	RegExp maps directly to a Javascript RegExp	11
JavaScript		13
Symbol	Not supported by the shell. If the shell gets a symbol from the database, it will convert it into a string.	14
32-bit integer	Numbers without decimal points will be saved as 32-bit integers.	16
Timestamp	BSON has a special timestamp type for internal MongoDB use and is not associated with the regular Date type. Timestamp values are a 64 bit value where :	17
	the first 32 bits are a time_t value (seconds since the Unix epoch).	
	the second 32 bits are an incrementing ordinal for operations within a given second.	
64-bit integer	Numbers without a decimal point will be saved and returned as 64-bit integers.	18

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Extensive Query Model

Rich Queries	• Find Paul's car • Find everybody in London with a car built between 1970 and 1980
Geo	• Find all car owners within 10m of Manhattan
Text Search	• Find all cars whose VIN starts with ZA1
Aggregation	• Calculate the average value of Paul's car collection
Map Reduce	• What is the ownership pattern of colors by geography over time? (Is silver trending up in the US?)

```
{
   first_name: 'Paul',
   surname: 'Miller',
   cell: '+447557505611'
   location: [45.123,47.232],
   profession: [banking, finance,
trader],
   cars: [
    { model: 'Bentley',
      year: 1973,
      value: 100000, … },
    { model: 'Rolls Royce',
     year: 1965,
     value: 330000, … }
   ]
}
```

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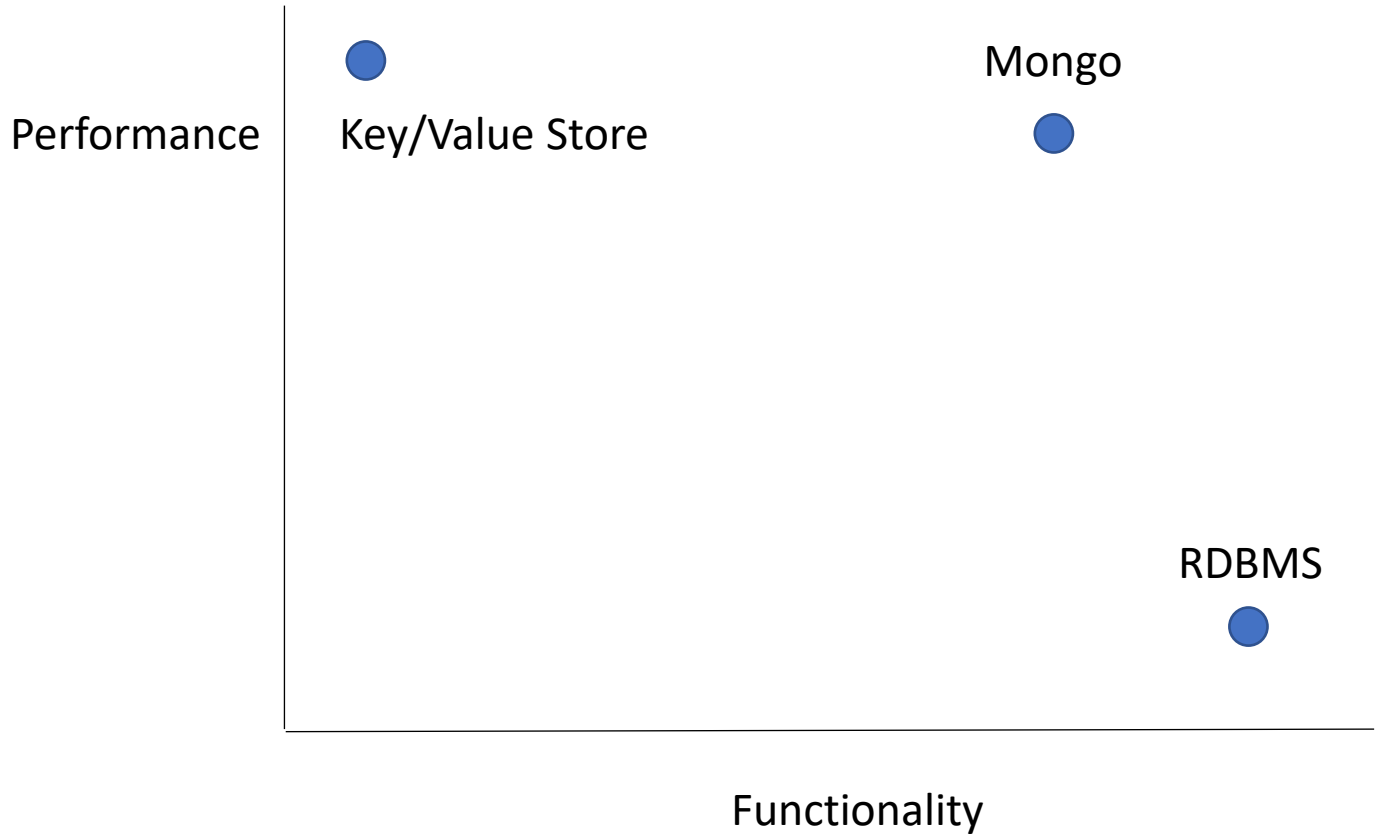
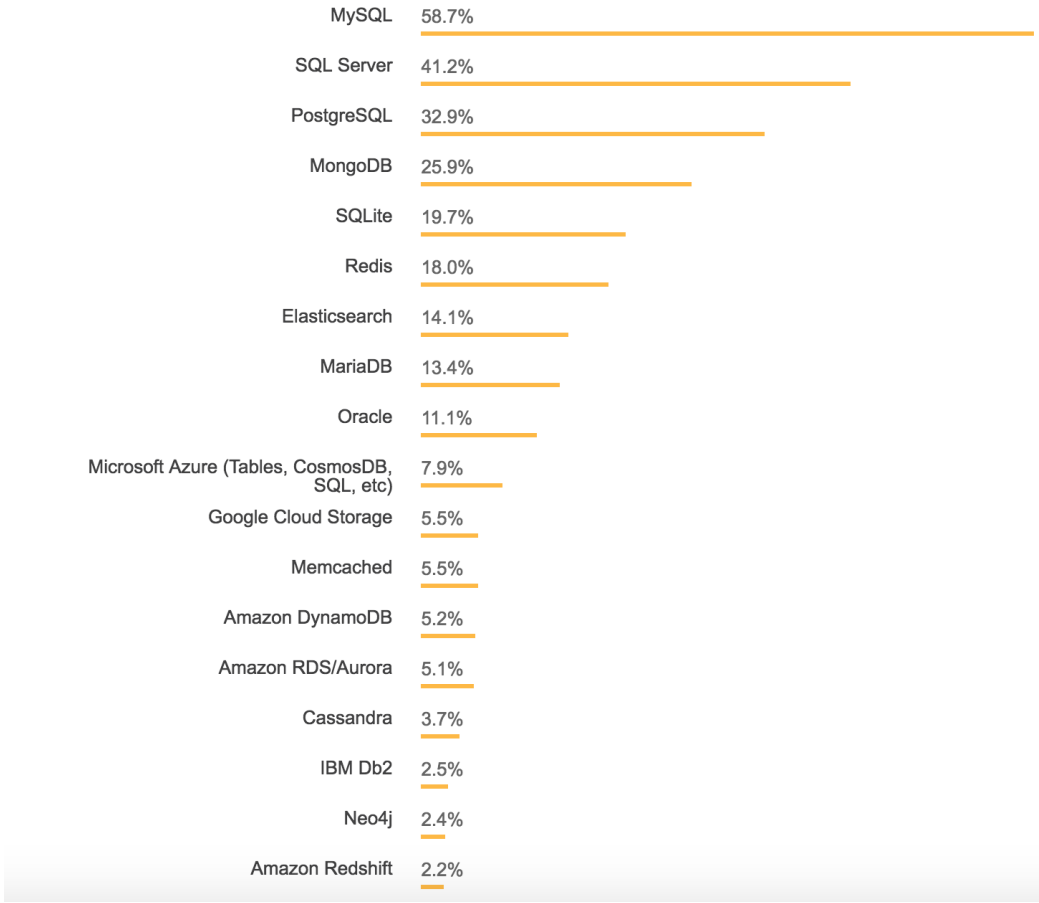
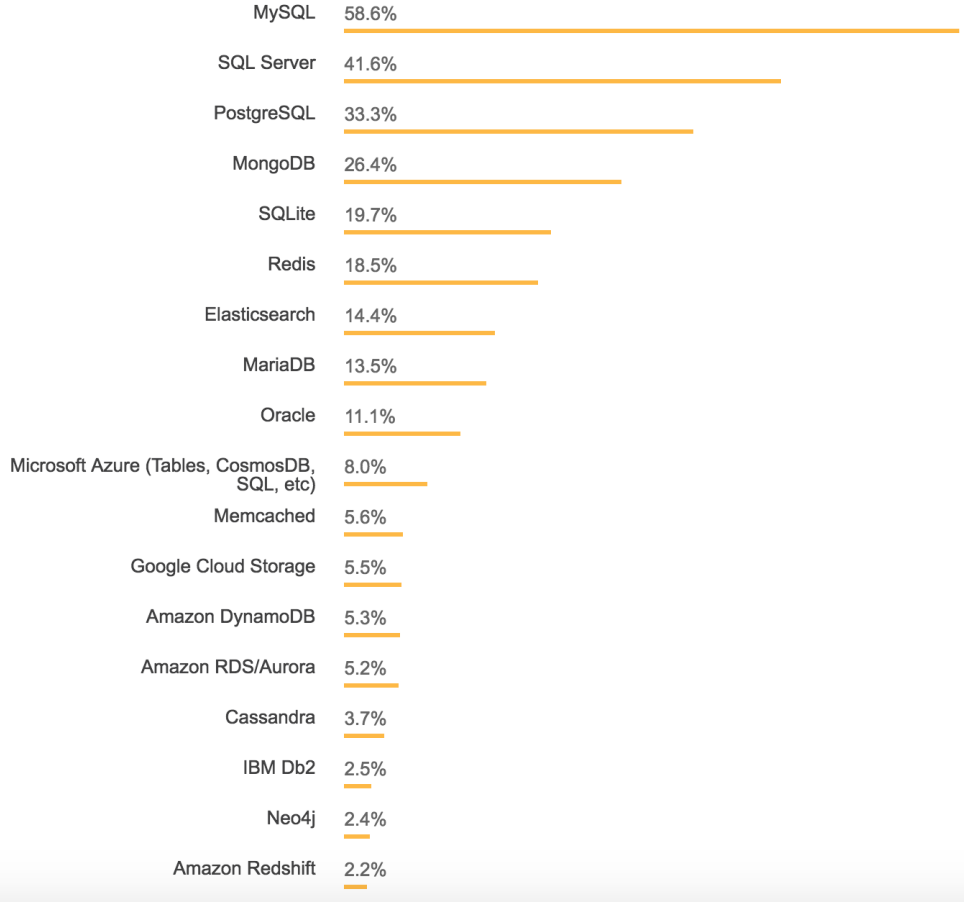
Mongo Strengths



Database Market Share





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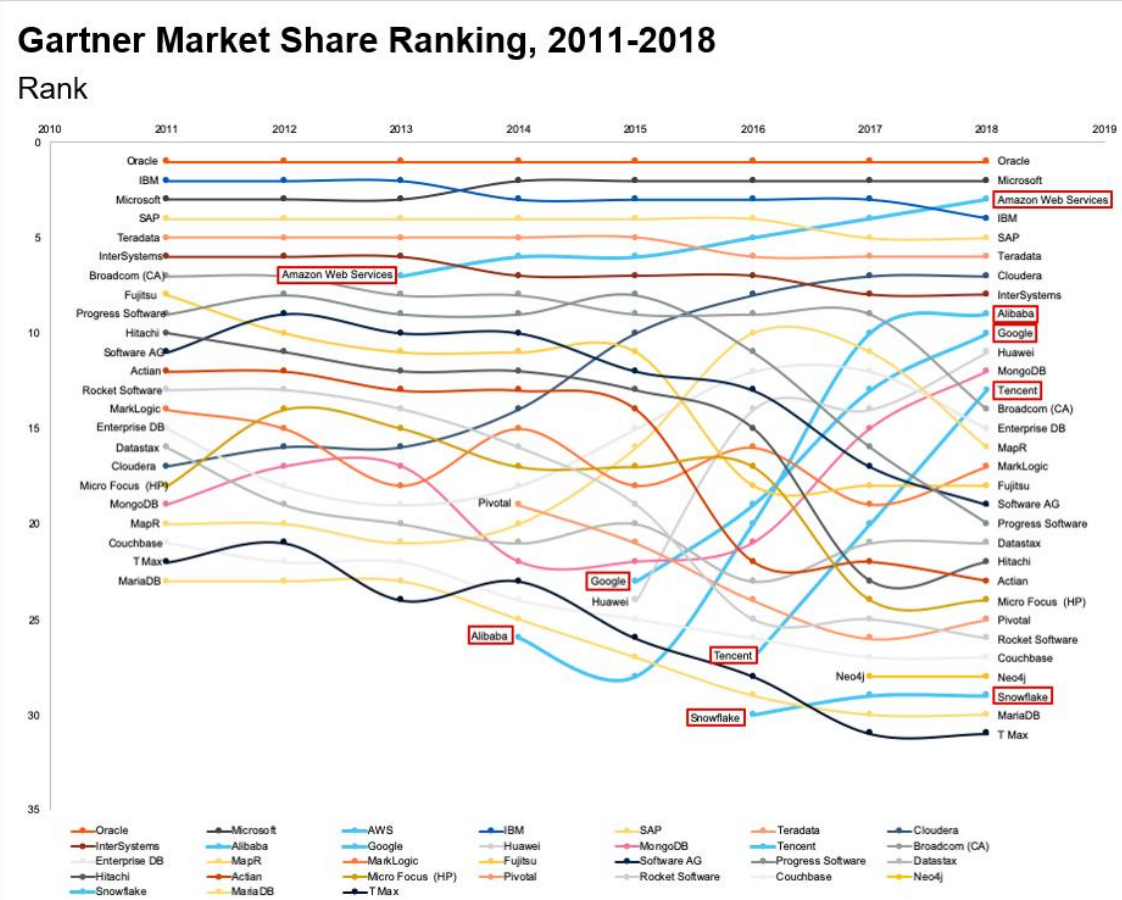
Market Share Ranking



Source: Gartner (June 2019)
Note: The following historical vendor revenues were combined to reflect the state of the market in 2019: Cloudera, reflecting the merger with Hortonworks; Micro Focus, reflecting the acquisition of HPE Vertica; Broadcom, reflecting the acquisition of CA.
ID: 347472

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Mongo Stock Price

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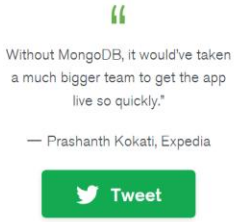
Customers



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The Weather Channel

- 2 million requests per day
- 40 million users with alerts
- Mobile backend as a service for Facebook
- 270,000 apps
- Unknown Workload
- API requests growing 500%

CraigsList

- 1.5 million new ads posted every day
- Archive billions of records
- Changing schema
- Scalability

Expedia Scratch Pad

- Needs to handle a lot of data and process a huge amount of information to automate, filter, and personalize to deliver the exact content
- Easy to customize all of the information pretty quickly and without any hassle
- Speed and ease of scalability as you can store the values in a single view
- Deliver results in real-time