

## MongoDB vs DocumentDB

**Cosmin Pintoiu** Solution Architect at Bigstep



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Designed and implemented critical message processing projects in financial sector and real-time analytics in retail sector.

Currently focused on large-scale real-time implementations, Data lakes and machine learning using Tensorflow.





## Agenda:

- Intro to Mongo and DocumentDB
- Setup Methodology
  - Node types
  - Network and AZ
- Benchmark using
  - Jmeter and custom sampler
  - YCSB
  - Mongo Socialite
- Price consideration
- Conclusions
- Q&A

Duration: 25m - 30m

# mongoDB®



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## MongoDB and DocumentDB

In this study, we will take a look at performance and cost aspects of running a MongoDB database environment on Bigstep Metal Cloud versus DocumentDB from AWS. To make it a fair comparison we will use similar resources and identical load tests.

- **MongoDB** is a cross platform document oriented database, was released 10 years ago and offers a multitude of features: indexing, replication, load balancing, aggregation, transactions.
- Amazon DocumentDB (with MongoDB compatibility) is a fast, scalable, highly available, and fully managed document database service that supports MongoDB workloads.

Our scope is to make this study impartial and easily reproducible, in this regard all the steps involved in setting up the environment and the test are available on github (https://github.com/ccpintoiu?tab=repositories).



#### **Benchmarks**

Considerations when performing benchmarks\*:

- **Relevant** (for users of the benchmark: engineering, marketing, buyers etc)
- **Repeatable** (results)
- Fairness (to both hw and sw involved)
- Verifiability (in case of audit)
- Economical (to set up, run and publish)

\* key aspects according to: Performance Evaluation and Benchmarking for the Era of Artificial Intelligence TPCTC 2018

Authors: Raghunath Nambiar and Meikel Poess

eBook:

https://play.google.com/store/books/details?id=ps6FDwAAQBAJ&rdid=book-ps6FDwAAQBAJ&rdot=1&source=gbs\_vpt\_read&pcampaignid=books\_booksearch\_viewport





## Node types

	Model	CPU	Memory	Storage	Network Performance		
Bigstep MongoDB	FMCI 8.32	8*	32 GB ECC	BSA	4 x 10 gbps		
AWS DocumentDB	db.r4.2xlarge	8 (vCPU)	61 GB	EBS-only**	high		
AWS MongoDB EC2	m5.2x.large	8 (vCPU)	32 GB	EBS-only**	Up to 10 gb		



# **Setup Mongo on Bigstep**

- <u>https://ctrl.bigstep.com/en/infrastructure/diagram?infrastructure\_id=2887</u>
- 1 Load node + 3 Mongo nodes
- Version 4.0.1

	bigs	step <sup>®</sup>		benchmark-mongodb4 (London, UK) 🗸 🗸
Install mongo DB cluster:		•		유 🌣
– set up private ips and /etc/hosts				
– add repo:				
– yum –y install mongodb–org				
– create folder: mkdir /data/mongod				
edit conf file on conf server: vim /etc/mongod.conf add: data file path and replSetName: "mongo_rs"		instance-loader-34433	instance-primaryrs-3 Instances: 1	instance-secondaryrs Instances: 2
- start the server:		ACTIVE	ACTIVE	ACTIVE
mongod —config /etc/mongod.conf		drive-array-44492 Drives: 1	drive-array-44493 Drives: 1	drive-array-44494 Drives: 2
rs.initiate()		ACTIVE	ACTIVE	ACTIVE
rs.add("mongod1")	e <sup>‡</sup> œ			
rs.status()				
rs.isMaster()				
			etwork-t	5546 📻

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# Setup DocumentDB

- 1 Load node (EC2) + 3 Mongo nodes (db.r4.2xlarge)
- API version 3.6

#### – setup EC2 instance

- ssh
- add repo for mongo shell
- sudo yum install -y mongodb-org-shell
- mongo ---ssl ---host docdb

#### NOTE:

- both docdb and ec2 instance should be in the same security group

 Connect from ouside to Document DB using port forwarding: nc -zv host port

Configuration	
Cluster identifier Info Specify a unique cluster identifier.	
docdb-2019-03-14-10-26-24	
nstance class Info	
db.r4.2xlarge 8 vCPUs 61GiB RAM	•
Number of instances Info	
3	•

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#### **Benchmark using**

**Jmeter** is a load testing tool used mostly on web apps but it can be used very well on databases. Is java based and supports variable parametrization.

This version uses ReactiveStreams 1.10 and the 3.9 Java MongoDB Driver and is tested with Jmeter version 5.0. It supports the following operations: read/write and readMany/writeMany.

**YCSB** is popular tool when comparing relative performance on NoSQL databases. Developed at Yahoo! for the specific purpose of comparative studies of various databases systems, YCSB is highly customizable. Workload files with 50/50 reads/writes, 75/25 and 95/5 to have a valid comparison.

**Socialite** is a test developed by Mongo team part of their regression testing for mongo product. This test simulates a social media platform with a number of users, followers and articles per user. The run command reads the first 100 iterations and writes the results into a file. The output file is quite rich, most important field is the mean\_rate, which shows the average ops/sec.



## **Jmeter test**

<u>https://github.com/bigstepinc/jmeter-mongo-db-custom-sampler</u> https://github.com/bigstepinc/jmeter-mongo-db-custom-sampler/releases/latest



## Jmeter test

#### Jmeter custom sampler read/write 50 threads Avg Ops/sec



#### Jmeter config file used:

50 threads (simulates users)

loop count: 40000 (how many times a thread group gets executed)

#### Run command and time:

./jmeter.sh -n -t /tmp/Jmeter-Bigstep\_1.3\_WRSingle4M.jmx -I /tmp/output\_jmxWRSingle4M.csv

## Jmeter test

3<sup>rd</sup> test including Mongo Db on AWS EC instance (all instances in one availability zone)



## **Jmeter distributed test**

Next steps: Stress test using Jmeter Distributed testing

We can use our Custom Mongo Sampler (one other option is: <u>https://github.com/johnlpage/POCDriver</u> )



The goal of YCSB project is to develop a framework and common set of workloads for evaluating the performance of different "key-value" and "cloud" serving stores.



Load command and time:

./bin/ycsb load mongodb -s -P workloads/workload\_small -threads 32 -p mongodb.url=mongodb://10.0.0.31:27017/?replicaSet=mongo\_rs&w=majority

Load time:	Bigstep MongoDB	AWS DocDB
load 4M	9m44.324s	45m44.28s

Example workload file used: requestdistribution=zipfian recordcount=4096000 operationcount=20000000 readallfields=true readproportion=0.5 updateproportion=0.5



eBook: Performance Evaluation and Benchmarking for the Era of Artificial

- db.usertable.count() 4096000
- 20GB
- W=majority
- 32 threads

#### writeConcern

#### readPreference:

•Allowed values are:

- errors\_ignored •
- unacknowledged •
- acknowledged
- journaled
- replica\_acknowledged nearest
- majority

•Allowed values are :

- primary
- primary\_preferred
- secondary
- secondary\_preferred

"_i	id" : "user3801616714551441941",	
"fi	ield19" : BinData(0,"Pyc+MjA/KTY3JCU/OC0yKSM8KzYpKDAtJi88LSk6OzklODcvPTU4PzAhJCc9NCwnKCowJyM9NTIxKyszKCI6MzIsKi4yKT8pJzkzJiozJDg0NiggJCQuODMuOictLz4yKjE4N	NA==")
"fi	ield17" : BinData(0,"JywgID05LSsuND0vKiwmNDQpJzIoIiwoLTA0Li41JCU/PiohLDs5NTE5PjUkLDs5OywpNSYuISQzNzUpNCcpJSk3KDotJDs+MykzMzgkLjM9NCUkNyQjKz0sMCQ2OyEjMjk5;	JQ==")
"fi	ield18" : BinData(0,"MjM5JjY5NDcwJig1Ij8mMT4lOTcrICc3LCA6Myg2OCg6OicoITE4PSI8MDYoITc3IiIoLDQkPTcjPTAlPi8oIzYzJiApNTEjOCclJz@nNDIyPjInJissKj09PCo9Ky8uJSw1	IA==")
"fi	ield22" : BinData(0,"JCw9PjM9PDEsPT4wIj0u0So3IyQm0zI5MTc2KzY6KDIlPjYmIiU5MjclJjc4NyctISQ0MSI+LjM7Kz09PSEmIyU9LyIjNCI80zohLS88Iik+KiwoND4l0SYwIiUtPzAsMT8k(	0A==")
"fj	ield23" : BinData(0,"0yApKT8gKT8rKywnNTY/ITkiIDI8LDEmJio9JT0jJSAoIyIqKygpJTcjNjIiMiklPTcj0zwwOyYnMCIkIS8uJT0/NCg+MiUq0DswJyYwLSU0ITksJjgqNy05NSkoMTIpIzw66	0Q==")
"fj	ield20" : BinData(0,"Li8/Kjc/MCg2OCA9LiQyOi0uMSM9MC02KCEqIi01LiQ2MiQgNywxKSkvMCo2OCQxPzg5PDQhOSIsMTkwKSkgJSEtPTo+KjktNyEyKiAkLykqNSo6KSQ0Pj4pOi0jISo0MjA4h	Ng==")
"fi	ield21" : BinData(0,"ITQgLzY1JD06Kz0lPiIiMz4zPTM/PSs2KyQoJi45PDwgNCEsLDI1NTs+LDQ/ICYmJT0hKjk7IywvNywjJzgsKScnIig3NiE/OSYuKDw4JSslIyQgJDo6MC4qNzc8JDkyND0wh	Nw==")
"fj	ield24" : BinData(0,"Kyw7PSIvISc9NCUjNDU4MiE9ISsoLDUqPi8z0y8nNTAkMzcjISczPjc0MycrNTslKSImLTghKT88MDwvIT8s0i4/ISgzMyA0IzwsMToyJz8jNS03PSss0TsnNzMoMy49LCQ9;	Jg==")
"fj	ield11" : BinData(0,"MCgnODk3PzU4IzUrKyU0PDo0NjQxPTs5MiA7MC4mIDErOyQ7LjUsLC8xJz81LjA7OjUjIjMvJT8xNzErJC8kJzQlPDYzNCUrJzUgNyIgJSYmJCMmNy4sJTY1MDkyMTUxIDo0;	JĀ==")
"fj	ield12" : BinData(0,"PicjNjgyJSk3JCkiPScjLiQ8JDEpPC4iLDs7IikoNjwwOSw6LjAqITQ5KSQ4OCkiITwjMzMgNTc5KjAjKiMsLiwgITQqOTA3PCArOyAiOjQpPSIjPjMmKSQ6MCM/KSQrPycth	Ng==")
"fj	ield1" : BinData(0,"MjohMD49LjgoPCY70CM+NCoiICUtMTslIzsw0CAtKSQzNj0w0ik2LC8rPDYoKyozMSg3PTwnIjMzMSIzMzYtMDghISskJTAqPyY0MSU7JjYpNjE2NTkv0CIyIDg+PDsqKSE4Py	w=="),
"fj	ield0" : BinData(0,"Pz40MSwrLC82JzUrIik3JCgoNys/LC0jID06Kig1MzQ3MSM2MTknNygnNTAq0zc2Ij46Pz8iKjQvMiU1NyEjNisnIicmPSMnKTAhLyotJS8lLjklIzYwLjYmKDMqNjs5KyY7NA	A=="),
"fj	ield10" : BinData(0,"Jj01KCkqMzgvNyAsLTElIy4oMj04LCkvLykiISo+Lzs4Ny0lKCo1ISQjICYmNikuMScwJDA4MjYoJy0yNjEoITo2MywiNTYqKSM3OjwiMC4sKyUuLi8oMjclKic+Jzk+LSooj	JA==")
"fj	ield15" : BinData(0,"MiM/MTsrLSEjKTMhMSIwNCc9KTogLSwwPzMvJyo0KCI5PD05MDs7PzYhKCAiLT0wKiEwOS40IjwzKj06PSghND8uKCg3OSgqNTMqPi87MSAsLSwvOSg1PzghKzw2MCQ5ID0/I	Lg==")
"fj	ield16" : BinData(0,"LDs/IS81NyMjNzciJCooPzQ8PjI2NSs8JjgqNiM9LCgqJiYnJCsuPSooKy86JD0uNzkrMiw6LjszIDokLiAwPSY+OzŪ4KCkkIyE3IDImPTozMyIhPSŪgNTksIjs3PTo2Ijo+h	MĀ==")
"fi	ield13" : BinData(0,"KT0vIjE4JSM4JyEnLjM8PSYvPD47NCM1JiEoNSgzMSo8NDEvIDE9PTALLzghPyw50yA0PjUiNyskJyE1PzM+NCIuPjk5NCwlNjEgPTUnJjcmPSMh0DkjJyUvPi4uIj4iJzA4	KQ==")
"fi	ield14" : BinData(0,"NyAuLyQgKzw3JCMuMSMnNzUnICktLjI4Iz0vIyE3NiI3NTIrLyshIyY1Ni83JzMuLyk/JCo2KysgPSUgIS4vKz0pOSAyJCs0Ii4iPzs+OjYkPS4pICU8IyInMjw/OiQgOSIy	Pw==")
"fi	ield7" : BinData(0,"MTgwKT0pIyc9JCY9Ljwg0zE7LiwzPSYnITQkJCUk0C43MTsiKiU60iUuNjQjJSEwISwhMycyNyoxLD8/MDs2NS4hMDsiMSoxMyM1KzEtMzgoLz0qIDkxOS0u0iI6PSAgJDE+Lg	g=="),
"fi	ield6" : BinData(0,"MykxPz0wMiUpLiE/JzQqIiI30CMxNSoxIDEvPzc50zAtPCkpLyAjLyE5JjoyNzY7ID02Lz86Ly4sNyw0JzkmJj8pISw8MDIyJDk+MCYiJzQo0So4MSQmIDM4NyQ1PSspPTozNa	g=="),
"fi	ield9" : BinData(0,"0zU4KCg30SwtPTc6KS84IiwkKTI1ISU8MDUzPCQ8NDMvJyE2KSI+KSMuNyM7IT43ICwlNSsyISg8ITUzJC4gPis5PioxKz4tPyw+NjQ8JDstJT89JTosLS89KzUzPzsg0SA5K	Ā=="),
"fi	ield8" : BinData(0,"PT81KyE0MCwxJTY3ITY90zI20DQ4NCU/LzY4MyMmIC8nNSk6IyAqMjw6LjooJysgJyw4PyQ6PyE3NzArMDglKyU3JjYpKjIrMz0nPDcrPjAsKS4nNDsxLjE/NCYrKjwpIz4jKa	g=="),
"fi	ield3" : BinData(0,"MzkiKjs5MyMkMi0xNyc80y0zPy8jPi4yNzoxNzwiNTgmIj09PyY00j4v0jU3KSk3MTUrJjEqJSwrLTA8Lzk1MyEsJz42PiY0NCAhPC8r0zw1MS8rJDQrLio0LCkhJC4jJi02M0	Q=="),
"fi	ield2" : BinData(0,"NyU1NSI9NiUwICEwNSg6IisqIT4iMzY+MDYtKDMzPTIhOyA7KzglJy0lPTAhIjwyLDYrIDQ3NjQyJCMvJTMkMC88LjktIyQgMTAhMSwtJzg5JyMxPj89LzcgKi41PichOyonP/	A=="),
"fi	ield5" : BinData(0,"PyAvNCk+KDkyLDMsLig3JTQlMCYhNCkkIi06MSwxPy4nJyA0IjQ4LyAvMSogPyI9JDsiKiQ3ISIiLzk/0zMqLTcxMjgkMTQyNDI/JjEkPTkoKzYkIDYnISQ+LCs0Nys5PC08Ly	w=="),
fj"	ield4" : BinData(0,"KjQ+NTsuMDsiNj84MT8rJywyJiYyOikxOy4q0D49IjExPC4qICYq0Sq5ISIkKDcjMComNzIpLjooOyqm0yAyPz4qJSUj0DEuLykjJTI0Ki83PSouNiktMSU1NCIpNCEqMyY/P0	Q==")

The first step is to load **4 million records** using 32 threads and count the time that each environment needs to complete the task.



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## Socialite

As with the YCSB tool, Socialite is quite complex and offers various load tests: benchmark, timeline-read-follower-ramp, send-ramp-followers.

The Socialite implementation uses 3 MongoDB collections by default called users, followers, following.

#### Load command and time:

java -jar ./target/socialite-0.0.1-SNAPSHOT.jar load --users 100000 --maxfollows 5000 --messages 20 --threads 32 sample-config.yml

#### Run command:

java -jar ./target/socialite-0.0.1-SNAPSHOT.jar timeline-read-follower-ramp --out output1 --start 1 --stop 100 sample-config.yml





## Socialite

### timeline-read-follower-ramp



Bigstep MongoDB — AWS DocDB



## Socialite



Ops/sec for: timeline-read-follower-ramp

#### **Cluster deployment and scalability**

For the moment **Bigstep** does not provide managed services on MongoDB. You can install the software off the shelf on the bare metal instances. The main advantage is that you can configure the cluster accordingly to your needs. Being a self-manage platform you can also setup up a Sharded Cluster which will offer you better performance on large amount of data.

AWS **DocumentDB** is ready for production and you can start loading data as soon as the instances are up. You don't have access on the management side of the services so the disadvantage is that you cannot customize. You use as it is.

	Create Cluster	Install Mongo	Scale (1 node)	Attach Worker s	Total time:
Bigstep Platform	12 min	10 min	-	-	22 min
AWS DocDB	12 min	-	4 min	2 min	18 min



#### **Cluster deployment and scalability**

Steps to take for scalability Bigstep or AWS EC cluster:

- deploy new instance
- configure private IP
- install mongodb
- add the new node in cluster

The work time is higher than DocumentDB as at the moment Bigstep does not provide MongoDB as an integrated service, yet some steps can be automated. DocumentDB is way easier to scale up to 15 replica nodes and grows the size of your storage volume automatically

Scale Cluster	Add Instance	Conf IP	Install Mongo	Add node in cluster	Total time:
Bigstep Platform	5 min	2 min	5 min	5 min	17 min
AWS DocDB	5 min	-	-	-	5 min



## **Costs for entire cluster:**

FULL METAL CLOUD INSTANCES	Description	Quantity	Reserved price (EUR/mth )	On deman d price (EUR/h )	Reserv ed price (USD/ mth)	On dema nd price (USD /h)	To Ma Re pri	tal onthly served ce (EUR)	To Ho de pri (El	tal urly On mand ice JR)
FMCI 8.32v2 - General Purpose	CPU: 1 x Intel Xeon E3- 1585L v5 - 4 cores 8 threads @ 3.3Ghz RAM: 32 GB DDR4 ECC Network: 2 x 10 GbE	1	189	0.30			€	189.00	€	225.00
Storage SSD Storage (100 GB)		100	0.15	0.00			€	14.62	€	19.50
Bigstep MongoDB							€	203.62	€	244.50
AWS r4.2xlarge	8 (vCPU) 61 GB EBS- only*	1	256.51	0.56	288.2	0.62	€	256.51	€	416.52
Storage	First 50 TB / Month - price per GB	100	0.02		\$0.02		€	10.32	€	10.32
AWS 1							€	266.83	€	426.84
AWS m5.2x.large	8 (vCPU) 32 GB EBS- only*	1	202.06	0.40	227	0.44	€	202.06	€	296.37
Storage	First 50 TB / Month - price per GB	100	0.02		\$0.02		€	10.32	€	10.32
AWS 2							€	212.38	€	306.69

#### **Costs for entire cluster:**



Price comparison



## **General Takeaways**



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Pick the right type of node

Perform custom tests for your problem

Take into account scalability and flexibility



# I'm all ears!









