Task 6: Cluster

Se crea la carpeta donde se va a almacenar el cluster. Se crea también las carpetas que incluirán los replica set (en nuestro caso 6 nodos) donde se almacenara la configuración de estos.

mkdir mongo_replica

mkdir mongo_replica/nodeX -> desde x=1 hasta x=6

Se crea una key para la autentificación entre nodos y una copia de cada servidor de MongoDB:

openssl rand -base64 741 > mongo_replica/keyfile

cp mongo_replica/keyfile mongo_replica/node1

mkdir mongo_replica/node1/db

Con el comando gedit mongo_replica/node1/mongo.conf (para cada nodo) se abrirá un "bloc de notas" donde se copiará la configuración aportada por el profesor:

storage: dbPath: /home/master/mongo_replica/nodeX/db

net: bindIp: localhost

port: 2701X

security: authorization: enabled

keyFile: /home/master/mongo_replica/nodeX/keyfile

systemLog: destination: file

path: /home/master/mongo_replica/nodeX/mongod.log

logAppend: true

replication: replSetName: master

processManagement: fork : true

Se genera los permisos para que solo pueda acceder el propietario de los servidores:

chmod 600 mongo_replica/node1/keyfile

Se arranca los servidores con el comando:

mongod -f mongo_replica/nodeX/mongo.conf

Para conectarse a uno de ellos e iniciar el replica set hay que utilizar estos dos comandos:

mongo --port 27011

rs.initiate()

Para generar un bloqueo de acceso se puede crear un usuario root:

use admin

db.createUser({ user: "admin", pwd: "pass", roles: [{role: "root", db: "admin"}]})

Para añadir los otros nodos al replica set, hay que acceder mediante el usuario creado anteriormente (siguiente comando) y usar el comando agregar puerto:

mongo --host "master/127.0.0.1:27011" -u "admin" -p "pass" --authenticationDatabase "admin"

rs.add("localhost:27012")

Y ya estaría listo la configuración y creación de 2 replica set con 3 nodos cada uno.

Procedemos ahora a implementar el shard.

Se crea las carpetas de configuración, las carpetas db dentro de estas y el archivo keyfile para cada uno de los nodos:

mkdir mongo_replica/config1

mkdir mongo_replica/config1/db

cp mongo_replica/keyfile mongo_replica/config1

Se generan ahora los 6 permisos de restricción:

chmod 600 mongo_replica/config1/keyfile

Se configuran ahora el archivo del servidor (hay 6):

gedit mongo_replica/config1/mongo.conf

Se abrirá un “bloc de notas” que habrá que introducir:

sharding: clusterRole: configsvr

replication: replSetName: csrs

security: keyFile: /home/master/mongo_replica/config1/keyfile

```
net:  bindIp: localhost
  port: 26001
systemLog:  destination: file
  path: /home/master/mongo_replica/config1/csrs.log
  logAppend: true
storage:  dbPath: /home/master/mongo_replica/config1/db
processManagement:
  fork : true
```

teniendo en cuenta que cambia de unos a otros en el puerto y el nombre.

Se arrancan los servidores (6):

```
mongod -f mongo_replica/config1/mongo.conf
```

Hay que conectarse con los puertos que se vayan a considerar PRIMARY (independientemente unos de otros):

```
mongo --port 26001
```

Se inicializan los PRIMARY(no cometer el error de usar el siguiente comando para inicializar aquellos que se considerarán SECUNDARY ya que sería un error fatídico):

```
rs.initiate()
```

Se hace uso del usuario “admin” y se crea un usuario para restringir el acceso. También hay que autentificarlo.

```
use admin

db.createUser({
  user: "admin",
  pwd: "pass",
  roles: [    {role: "root", db: "admin"}   ]
})

db.auth("admin", "pass")
```

Ahora, se añaden los SECUNDARY al PRIMARY:

```
rs.add("localhost:26002")
```

y con el comando rs.status() comprobamos que se han añadido correctamente.

Una vez realizado esto se procede a configurar MONGOS. Hay que tener en cuenta que aquí se añaden todos los puertos que se van a utilizar para crear el cluster. Se escribe el comando gedit mongo_replica/mongos.conf en el terminal y se pondrá dentro del "bloc de notas" la siguiente información:

```
sharding:  configDB: csrs/localhost:26001,localhost:26002,localhost:26003

security:  keyFile: /home/master/mongo_replica/keyfile

net:  bindIp: localhost

 port: 26000

systemLog:

 destination: file

 path: /home/master/mongo_replica/mongos.log

 logAppend: true

processManagement:

 fork : true
```

Se modifican los permisos de la keyfile:

```
chmod 600 /home/master/mongo_replica/keyfile
```

En este momento se va a comenzar a configurar y crear los replica sets.

Para ello se crean los directorios, dentro de cada directorio el servidor de MongoDB, se restringe el acceso para aquellos que no sean el propietario. En este caso se ha de hacer para 6.

```
mkdir mongo_replica/rep11

cp mongo_replica/keyfile mongo_replica/rep12

chmod 600 mongo_replica/rep11/keyfile

mkdir mongo_replica/rep11/db
```

Se configuran los replica sets poniendo el siguiente comando (6 veces)

```
gedit mongo_replica/rep11/mongo.conf
```

Se escribe dentro del “bloc de notas” la siguiente información:

```
sharding:
  clusterRole: shardsvr
storage:  dbPath: /home/master/mongo_replica/rep11/db
  wiredTiger:    engineConfig:
     cacheSizeGB: .1
net:
  bindIp: localhost
  port: 27111
security:  keyFile: /home/master/mongo_replica/rep11/keyfile
systemLog:
  destination: file
  path: /home/master/mongo_replica/rep11/mongod.log
  logAppend: true
replication:  replSetName: repl1
processManagement:
  fork : true
```

Una vez hecho esto para los 6 nodos que vamos a utilizar, se inicializan los 6 servidores:

```
mongod -f mongo_replica/rep11/mongo.conf
```

y se crea un super-usuario en cada replica-set, en este caso 2. Para ello hay que conectarse con los que se consideren PRIMARY y seguir los siguientes pasos:

```
mongo --port 27111


rs.initiate()


use admin


db.createUser({
  user: "admin",
  pwd: "pass",
```

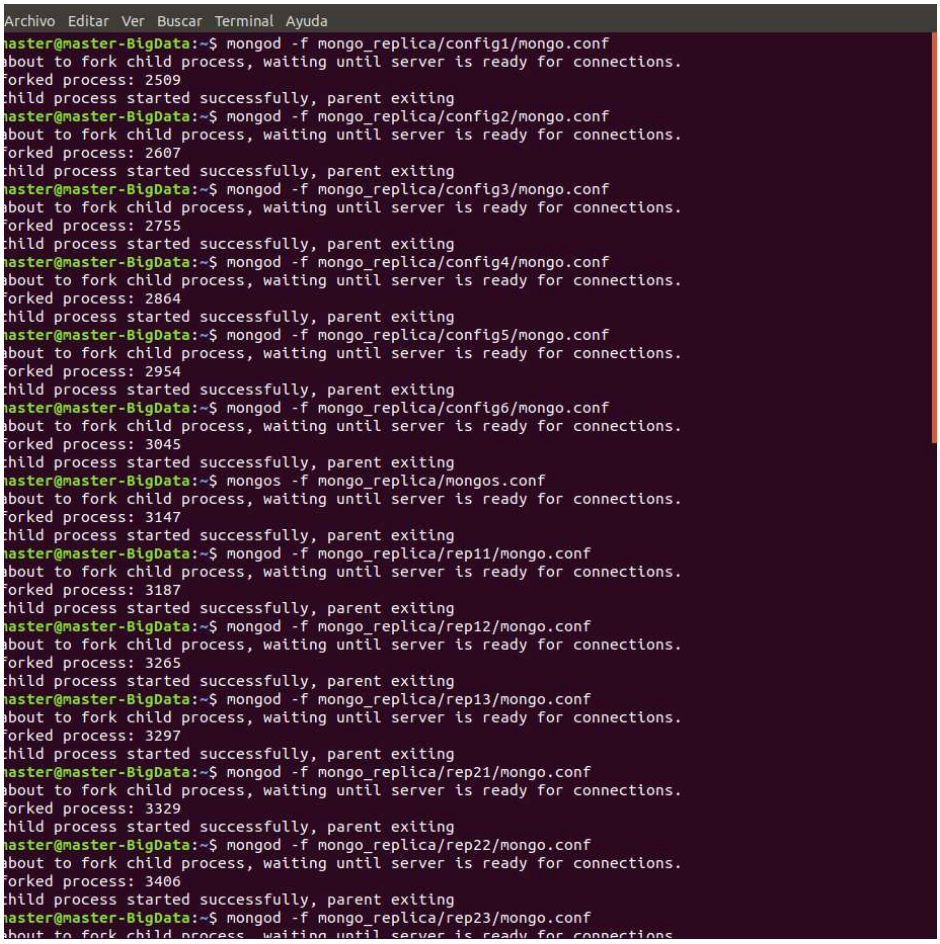
roles: [{role: "root", db: "admin"}]

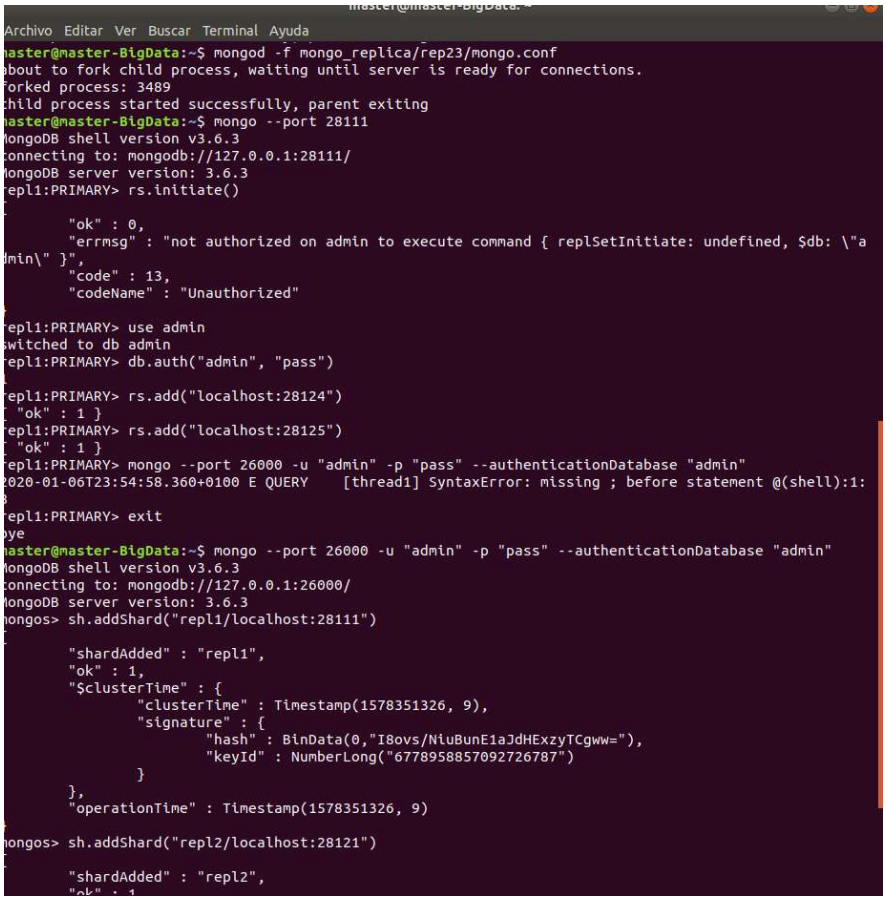
})

db.auth("admin", "pass")

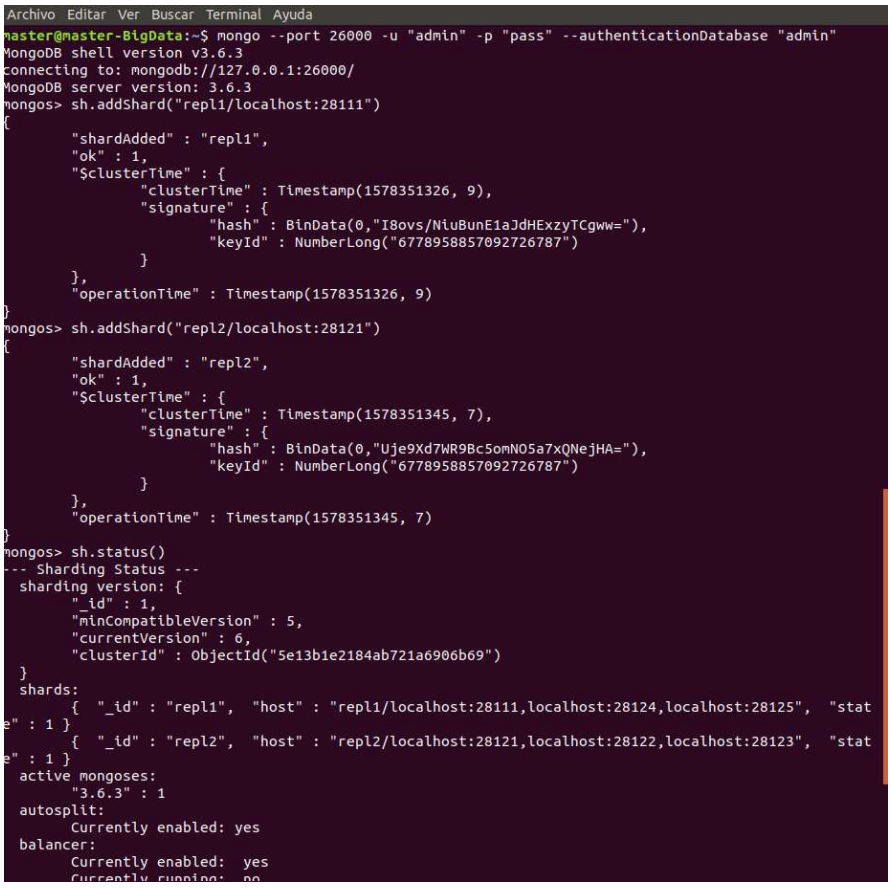
Se añaden ahora los SECUNDARY:

rs.add("localhost:27112")





```
Archivo  Editar  Ver  Buscar  Terminal  Ayuda
master@master-BigData:~$ mongod -f mongo_replica/rep23/mongo.conf
about to fork child process, waiting until server is ready for connections.
forked process: 3489
child process started successfully, parent exiting
master@master-BigData:~$ mongo --port 28111
MongoDB shell version v3.6.3
connecting to: mongodb://127.0.0.1:28111/
MongoDB server version: 3.6.3
repl1:PRIMARY> rs.initiate()
{
        "ok" : 0,
        "errmsg" : "not authorized on admin to execute command { replSetInitiate: undefined, $db: \"a
dmin\" }",
        "code" : 13,
        "codeName" : "Unauthorized"
}
repl1:PRIMARY> use admin
switched to db admin
repl1:PRIMARY> db.auth("admin", "pass")
1
repl1:PRIMARY> rs.add("localhost:28124")
{ "ok" : 1 }
repl1:PRIMARY> rs.add("localhost:28125")
{ "ok" : 1 }
repl1:PRIMARY> mongo --port 26000 -u "admin" -p "pass" --authenticationDatabase "admin"
2020-01-06T23:54:58.360+0100 E QUERY    [thread1] SyntaxError: missing ; before statement @(shell):1:
8
repl1:PRIMARY> exit
bye
master@master-BigData:~$ mongo --port 26000 -u "admin" -p "pass" --authenticationDatabase "admin"
MongoDB shell version v3.6.3
connecting to: mongodb://127.0.0.1:26000/
MongoDB server version: 3.6.3
mongos> sh.addShard("repl1/localhost:28111")
{
        "shardAdded" : "repl1",
        "ok" : 1,
        "$clusterTime" : {
                "clusterTime" : Timestamp(1578351326, 9),
                "signature" : {
                        "hash" : BinData(0,"I8ovs/NiuBunE1aJdHExzyTCgww="),
                        "keyId" : NumberLong("6778958857092726787")
                }
        },
        "operationTime" : Timestamp(1578351326, 9)
}
mongos> sh.addShard("repl2/localhost:28121")
{
        "shardAdded" : "repl2",
        "ok" : 1,
```



```
Archivo  Editar  Ver  Buscar  Terminal  Ayuda
master@master-BigData:~$ mongo --port 26000 -u "admin" -p "pass" --authenticationDatabase "admin"
MongoDB shell version v3.6.3
connecting to: mongodb://127.0.0.1:26000/
MongoDB server version: 3.6.3
mongos> sh.addShard("repl1/localhost:28111")
{
        "shardAdded" : "repl1",
        "ok" : 1,
        "$clusterTime" : {
                "clusterTime" : Timestamp(1578351326, 9),
                "signature" : {
                        "hash" : BinData(0,"I8ovs/NiuBunE1aJdHExzyTCgww="),
                        "keyId" : NumberLong("6778958857092726787")
                }
        },
        "operationTime" : Timestamp(1578351326, 9)
}
mongos> sh.addShard("repl2/localhost:28121")
{
        "shardAdded" : "repl2",
        "ok" : 1,
        "$clusterTime" : {
                "clusterTime" : Timestamp(1578351345, 7),
                "signature" : {
                        "hash" : BinData(0,"Uje9Xd7WR9Bc5omNO5a7xQNejHA="),
                        "keyId" : NumberLong("6778958857092726787")
                }
        },
        "operationTime" : Timestamp(1578351345, 7)
}
mongos> sh.status()
--- Sharding Status ---
  sharding version: {
        "_id" : 1,
        "minCompatibleVersion" : 5,
        "currentVersion" : 6,
        "clusterId" : ObjectId("5e13b1e2184ab721a6906b69")
  }
  shards:
        {  "_id" : "repl1",  "host" : "repl1/localhost:28111,localhost:28124,localhost:28125",  "stat
e" : 1 }
        {  "_id" : "repl2",  "host" : "repl2/localhost:28121,localhost:28122,localhost:28123",  "stat
e" : 1 }
  active mongoses:
        "3.6.3" : 1
  autosplit:
        Currently enabled: yes
  balancer:
        Currently enabled:  yes
        Currently running:  no
```

```
Archivo  Editar  Ver  Buscar  Terminal  Ayuda
        Currently running:  no
        Failed balancer rounds in last 5 attempts:  0
        Migration Results for the last 24 hours:
                No recent migrations
  databases:
        {  "_id" : "config",  "primary" : "config",  "partitioned" : true }
                config.system.sessions
                        shard key: { "_id" : 1 }
                        unique: false
                        balancing: true
                        chunks:
                                repl1   1
                        { "_id" : { "$minKey" : 1 } } -->> { "_id" : { "$maxKey" : 1 } } on : repl1 T
imestamp(1, 0)

mongos> use config
switched to db config
mongos> db.collections.find().pretty()
{
        "_id" : "config.system.sessions",
        "lastmodEpoch" : ObjectId("5e13bb1ac06498bef4b69bc0"),
        "lastmod" : ISODate("1970-02-19T17:02:47.296Z"),
        "dropped" : false,
        "key" : {
                "_id" : 1
        },
        "unique" : false,
        "uuid" : UUID("a997786e-8961-4bd3-b9fb-065889bec605")
}
mongos> db.shards.find().pretty()
{
        "_id" : "repl1",
        "host" : "repl1/localhost:28111,localhost:28124,localhost:28125",
        "state" : 1
}
{
        "_id" : "repl2",
        "host" : "repl2/localhost:28121,localhost:28122,localhost:28123",
        "state" : 1
}
mongos> db.chunks.find().pretty()
{
        "_id" : "config.system.sessions-_id_MinKey",
        "ns" : "config.system.sessions",
        "min" : {
                "_id" : { "$minKey" : 1 }
        },
        "max" : {
                "_id" : { "$maxKey" : 1 }
        },
```

```
        "lastmodEpoch" : ObjectId("5e13bb1ac06498bef4b69bc0")
}
mongos> exit
bye
master@master-BigData:~$ mongoimport --drop products.json --port 26000 -u "admin" -p "pass" --authent
icationDatabase "admin" --db shardlesson --collection products
2020-01-07T11:04:43.078+0100    connected to: localhost:26000
2020-01-07T11:04:43.079+0100    dropping: shardlesson.products
2020-01-07T11:04:46.304+0100    [##......................] shardlesson.products 9.81MB/87.9MB (11.2%)
2020-01-07T11:04:49.054+0100    [#####...................] shardlesson.products 20.5MB/87.9MB (23.3%)
2020-01-07T11:04:52.054+0100    [########................] shardlesson.products 31.7MB/87.9MB (36.0%)
2020-01-07T11:04:55.054+0100    [###########.............] shardlesson.products 43.1MB/87.9MB (49.0%)
2020-01-07T11:04:58.054+0100    [##############..........] shardlesson.products 54.3MB/87.9MB (61.8%)
2020-01-07T11:05:01.054+0100    [#################.......] shardlesson.products 65.8MB/87.9MB (74.8%)
2020-01-07T11:05:04.054+0100    [####################....] shardlesson.products 77.6MB/87.9MB (88.3%)
2020-01-07T11:05:07.054+0100    [######################.] shardlesson.products 87.3MB/87.9MB (99.3%)
2020-01-07T11:05:07.450+0100    [########################] shardlesson.products 87.9MB/87.9MB (100.0%
)
2020-01-07T11:05:07.450+0100    imported 516784 documents
master@master-BigData:~$ sh.enableSharding("shardlesson")
bash: error sintáctico cerca del elemento inesperado `"shardlesson"'
master@master-BigData:~$ mongo --port 26000 -u "admin" -p "pass" --authenticationDatabase "admin"
MongoDB shell version v3.6.3
connecting to: mongodb://127.0.0.1:26000/
MongoDB server version: 3.6.3
mongos> use admin
switched to db admin
mongos> sh.enableSharding("shardlesson")
{
        "ok" : 1,
        "$clusterTime" : {
                "clusterTime" : Timestamp(1578391586, 5),
                "signature" : {
                        "hash" : BinData(0,"18LGGNRgdV2HJtjQk2I9BgAatmE="),
                        "keyId" : NumberLong("6778958857092726787")
                }
        },
        "operationTime" : Timestamp(1578391586, 5)
}
mongos>
```

```
        "operationTime" : Timestamp(1578391586, 5)
}
mongos> use shardlesson
switched to db shardlesson
mongos> db.products.findOne()
{
        "_id" : ObjectId("573f7197f29313caab89b21d"),
        "sku" : 20000035,
        "name" : "Hedgehog's Dilemma - CD",
        "type" : "Music",
        "regularPrice" : 14.99,
        "salePrice" : 14.99,
        "shippingWeight" : "0.25"
}
mongos> db.products.createIndex( { "sku" : 1 } )
{
        "raw" : {
                "repl2/localhost:28121,localhost:28122,localhost:28123" : {
                        "createdCollectionAutomatically" : false,
                        "numIndexesBefore" : 1,
                        "numIndexesAfter" : 2,
                        "ok" : 1
                }
        },
        "ok" : 1,
        "$clusterTime" : {
                "clusterTime" : Timestamp(1578391646, 1),
                "signature" : {
                        "hash" : BinData(0,"FG4+3z6yBSOoGM8JhSwJjwCbGqc="),
                        "keyId" : NumberLong("6778958857092726787")
                }
        },
        "operationTime" : Timestamp(1578391646, 1)
}
mongos>
```

```
                }
        },
        "operationTime" : Timestamp(1578391646, 1)

mongos> sh.shardCollection("shardlesson.products", {"sku" : 1 } )

        "collectionsharded" : "shardlesson.products",
        "collectionUUID" : UUID("bcc6a8b2-5bad-4033-80bf-a3ef12b0bb2e"),
        "ok" : 1,
        "$clusterTime" : {
                "clusterTime" : Timestamp(1578391696, 12),
                "signature" : {
                        "hash" : BinData(0,"P8babKVilh7wWuM0rwkByerAMxQ="),
                        "keyId" : NumberLong("6778958857092726787")
                }
        },
        "operationTime" : Timestamp(1578391696, 12)

mongos> sh.status()
--- Sharding Status ---
  sharding version: {
        "_id" : 1,
        "minCompatibleVersion" : 5,
        "currentVersion" : 6,
        "clusterId" : ObjectId("5e13b1e2184ab721a6906b69")
  }
  shards:
        {  "_id" : "repl1",  "host" : "repl1/localhost:28111,localhost:28124,localhost:28125",  "stat
e" : 1 }
        {  "_id" : "repl2",  "host" : "repl2/localhost:28121,localhost:28122,localhost:28123",  "stat
e" : 1 }
  active mongoses:
        "3.6.3" : 1
  autosplit:
        Currently enabled: yes
  balancer:
        Currently enabled:  yes
        Currently running:  yes
        Collections with active migrations:
                shardlesson.products started at Tue Jan 07 2020 11:08:24 GMT+0100 (CET)
        Failed balancer rounds in last 5 attempts:  0
        Migration Results for the last 24 hours:
                No recent migrations
  databases:
        {  "_id" : "config",  "primary" : "config",  "partitioned" : true }
```

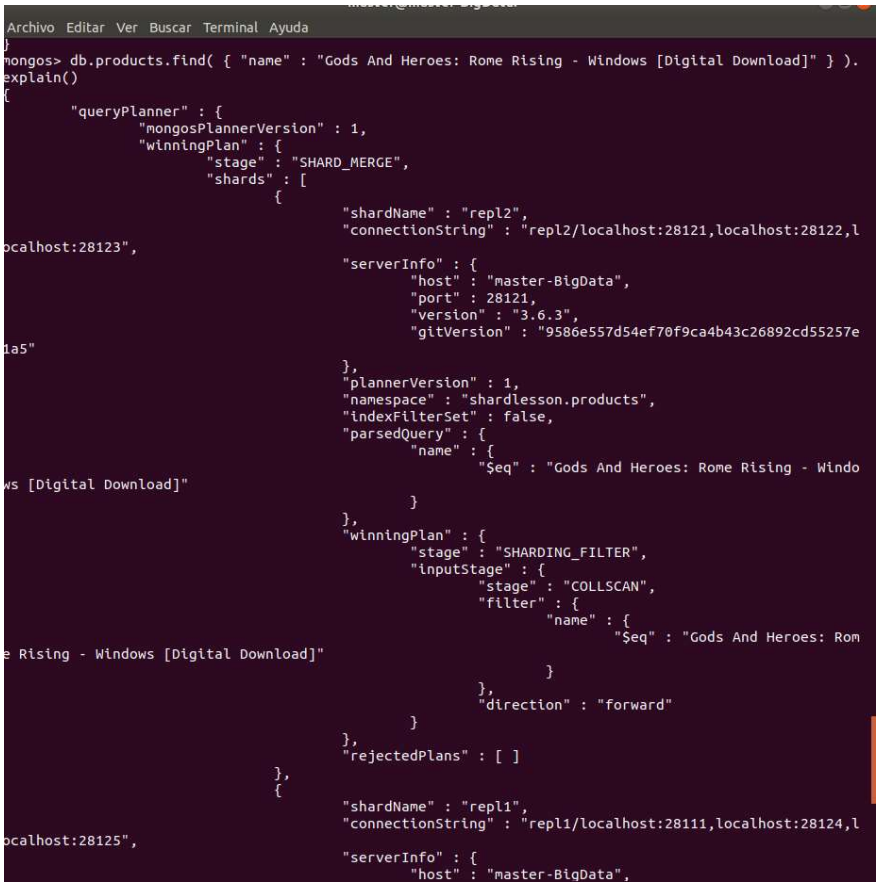
```
mongos> sh.status()
--- Sharding Status ---
  sharding version: {
        "_id" : 1,
        "minCompatibleVersion" : 5,
        "currentVersion" : 6,
        "clusterId" : ObjectId("5e13b1e2184ab721a6906b69")
  }
  shards:
        {  "_id" : "repl1",  "host" : "repl1/localhost:28111,localhost:28124,localhost:28125",  "stat
e" : 1 }
        {  "_id" : "repl2",  "host" : "repl2/localhost:28121,localhost:28122,localhost:28123",  "stat
e" : 1 }
  active mongoses:
        "3.6.3" : 1
  autosplit:
        Currently enabled: yes
  balancer:
        Currently enabled:  yes
        Currently running:  yes
        Collections with active migrations:
                shardlesson.products started at Tue Jan 07 2020 11:08:24 GMT+0100 (CET)
        Failed balancer rounds in last 5 attempts:  0
        Migration Results for the last 24 hours:
                No recent migrations
  databases:
        {  "_id" : "config",  "primary" : "config",  "partitioned" : true }
                config.system.sessions
                        shard key: { "_id" : 1 }
                        unique: false
                        balancing: true
                        chunks:
                                repl1   1
                        { "_id" : { "$minKey" : 1 } } -->> { "_id" : { "$maxKey" : 1 } } on : repl1 T
imestamp(1, 0)
        {  "_id" : "shardlesson",  "primary" : "repl2",  "partitioned" : true }
                shardlesson.products
                        shard key: { "sku" : 1 }
                        unique: false
                        balancing: true
                        chunks:
                                repl2   3
                        { "sku" : { "$minKey" : 1 } } -->> { "sku" : 23153496 } on : repl2 Timestamp(
1, 0)
                        { "sku" : 23153496 } -->> { "sku" : 28928914 } on : repl2 Timestamp(1, 1)
                        { "sku" : 28928914 } -->> { "sku" : { "$maxKey" : 1 } } on : repl2 Timestamp(
1, 2)

mongos>
```

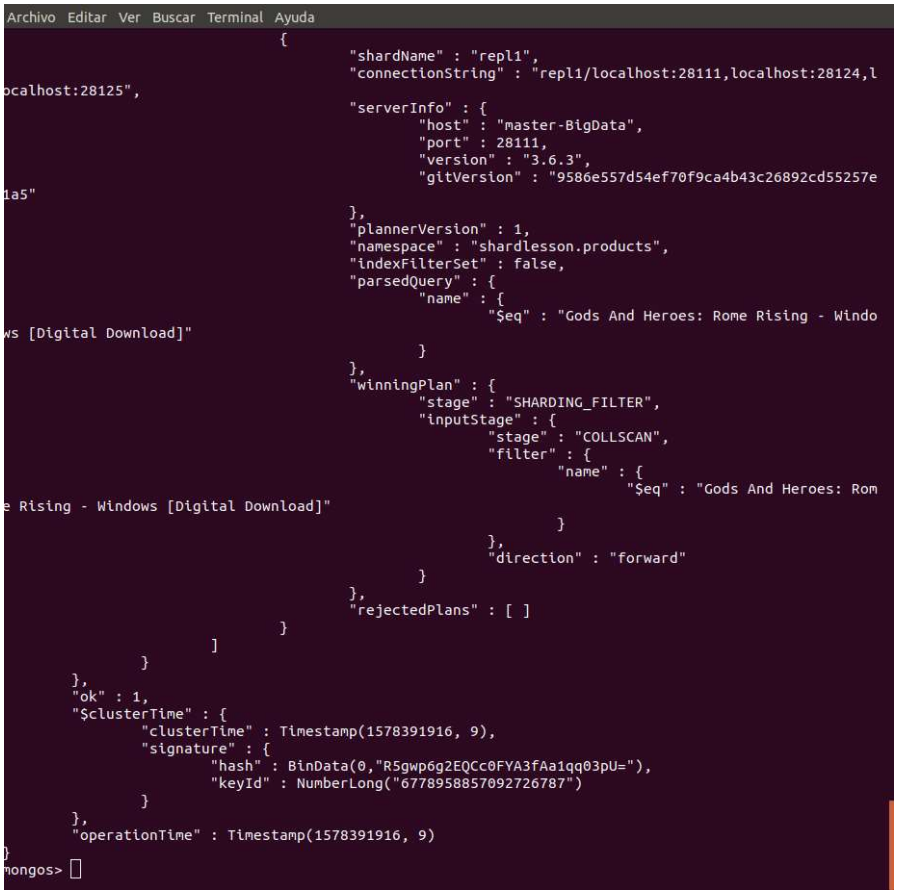
Se realiza ahora la primera query con .explain()

```
mongos> db.products.find({"sku" : 1000000749 }).explain()
{
        "queryPlanner" : {
                "mongosPlannerVersion" : 1,
                "winningPlan" : {
                        "stage" : "SINGLE_SHARD",
                        "shards" : [
                                {
                                        "shardName" : "repl2",
                                        "connectionString" : "repl2/localhost:28121,localhost:28122,l
ocalhost:28123",
                                        "serverInfo" : {
                                                "host" : "master-BigData",
                                                "port" : 28121,
                                                "version" : "3.6.3",
                                                "gitVersion" : "9586e557d54ef70f9ca4b43c26892cd55257e
1a5"
                                        },
                                        "plannerVersion" : 1,
                                        "namespace" : "shardlesson.products",
                                        "indexFilterSet" : false,
                                        "parsedQuery" : {
                                                "sku" : {
                                                        "$eq" : 1000000749
                                                }
                                        },
                                        "winningPlan" : {
                                                "stage" : "FETCH",
                                                "inputStage" : {
                                                        "stage" : "SHARDING_FILTER",
                                                        "inputStage" : {
                                                                "stage" : "IXSCAN",
                                                                "keyPattern" : {
                                                                        "sku" : 1
                                                                },
                                                                "indexName" : "sku_1",
                                                                "isMultiKey" : false,
                                                                "multiKeyPaths" : {
                                                                        "sku" : [ ]
                                                                },
                                                                "isUnique" : false,
                                                                "isSparse" : false,
                                                                "isPartial" : false,
                                                                "indexVersion" : 2,
                                                                "direction" : "forward",
                                                                "indexBounds" : {
                                                                        "sku" : [
                                                                                "[1000000749.0, 10000
00749.0]"
```

```
                                                                        "sku" : [ ]
                                                                },
                                                                "isUnique" : false,
                                                                "isSparse" : false,
                                                                "isPartial" : false,
                                                                "indexVersion" : 2,
                                                                "direction" : "forward",
                                                                "indexBounds" : {
                                                                        "sku" : [
                                                                                "[1000000749.0, 10000
00749.0]"
                                                                        ]
                                                                }
                                                        }
                                                }
                                        },
                                        "rejectedPlans" : [ ]
                                }
                        ]
                }
        },
        "ok" : 1,
        "$clusterTime" : {
                "clusterTime" : Timestamp(1578391789, 1),
                "signature" : {
                        "hash" : BinData(0,"JkvuGsUlwYUvP0Xnpf5UEjxNcWo="),
                        "keyId" : NumberLong("6778958857092726787")
                }
        },
        "operationTime" : Timestamp(1578391782, 1)
}
mongos>
```



```
Archivo  Editar  Ver  Buscar  Terminal  Ayuda
}
mongos> db.products.find( { "name" : "Gods And Heroes: Rome Rising - Windows [Digital Download]" } ).
explain()
{
        "queryPlanner" : {
                "mongosPlannerVersion" : 1,
                "winningPlan" : {
                        "stage" : "SHARD_MERGE",
                        "shards" : [
                                {
                                        "shardName" : "repl2",
                                        "connectionString" : "repl2/localhost:28121,localhost:28122,l
ocalhost:28123",
                                        "serverInfo" : {
                                                "host" : "master-BigData",
                                                "port" : 28121,
                                                "version" : "3.6.3",
                                                "gitVersion" : "9586e557d54ef70f9ca4b43c26892cd55257e
1a5"
                                        },
                                        "plannerVersion" : 1,
                                        "namespace" : "shardlesson.products",
                                        "indexFilterSet" : false,
                                        "parsedQuery" : {
                                                "name" : {
                                                        "$eq" : "Gods And Heroes: Rome Rising - Windo
ws [Digital Download]"
                                                }
                                        },
                                        "winningPlan" : {
                                                "stage" : "SHARDING_FILTER",
                                                "inputStage" : {
                                                        "stage" : "COLLSCAN",
                                                        "filter" : {
                                                                "name" : {
                                                                        "$eq" : "Gods And Heroes: Rom
e Rising - Windows [Digital Download]"
                                                                }
                                                        },
                                                        "direction" : "forward"
                                                }
                                        },
                                        "rejectedPlans" : [ ]
                                },
                                {
                                        "shardName" : "repl1",
                                        "connectionString" : "repl1/localhost:28111,localhost:28124,l
ocalhost:28125",
                                        "serverInfo" : {
                                                "host" : "master-BigData",
```



```
Archivo  Editar  Ver  Buscar  Terminal  Ayuda
                                {
                                        "shardName" : "repl1",
                                        "connectionString" : "repl1/localhost:28111,localhost:28124,l
ocalhost:28125",
                                        "serverInfo" : {
                                                "host" : "master-BigData",
                                                "port" : 28111,
                                                "version" : "3.6.3",
                                                "gitVersion" : "9586e557d54ef70f9ca4b43c26892cd55257e
1a5"
                                        },
                                        "plannerVersion" : 1,
                                        "namespace" : "shardlesson.products",
                                        "indexFilterSet" : false,
                                        "parsedQuery" : {
                                                "name" : {
                                                        "$eq" : "Gods And Heroes: Rome Rising - Windo
ws [Digital Download]"
                                                }
                                        },
                                        "winningPlan" : {
                                                "stage" : "SHARDING_FILTER",
                                                "inputStage" : {
                                                        "stage" : "COLLSCAN",
                                                        "filter" : {
                                                                "name" : {
                                                                        "$eq" : "Gods And Heroes: Rom
e Rising - Windows [Digital Download]"
                                                                }
                                                        },
                                                        "direction" : "forward"
                                                }
                                        },
                                        "rejectedPlans" : [ ]
                                }
                        ]
                }
        },
        "ok" : 1,
        "$clusterTime" : {
                "clusterTime" : Timestamp(1578391916, 9),
                "signature" : {
                        "hash" : BinData(0,"R5gwp6g2EQCc0FYA3fAa1qq03pU="),
                        "keyId" : NumberLong("6778958857092726787")
                }
        },
        "operationTime" : Timestamp(1578391916, 9)
}
mongos>
```

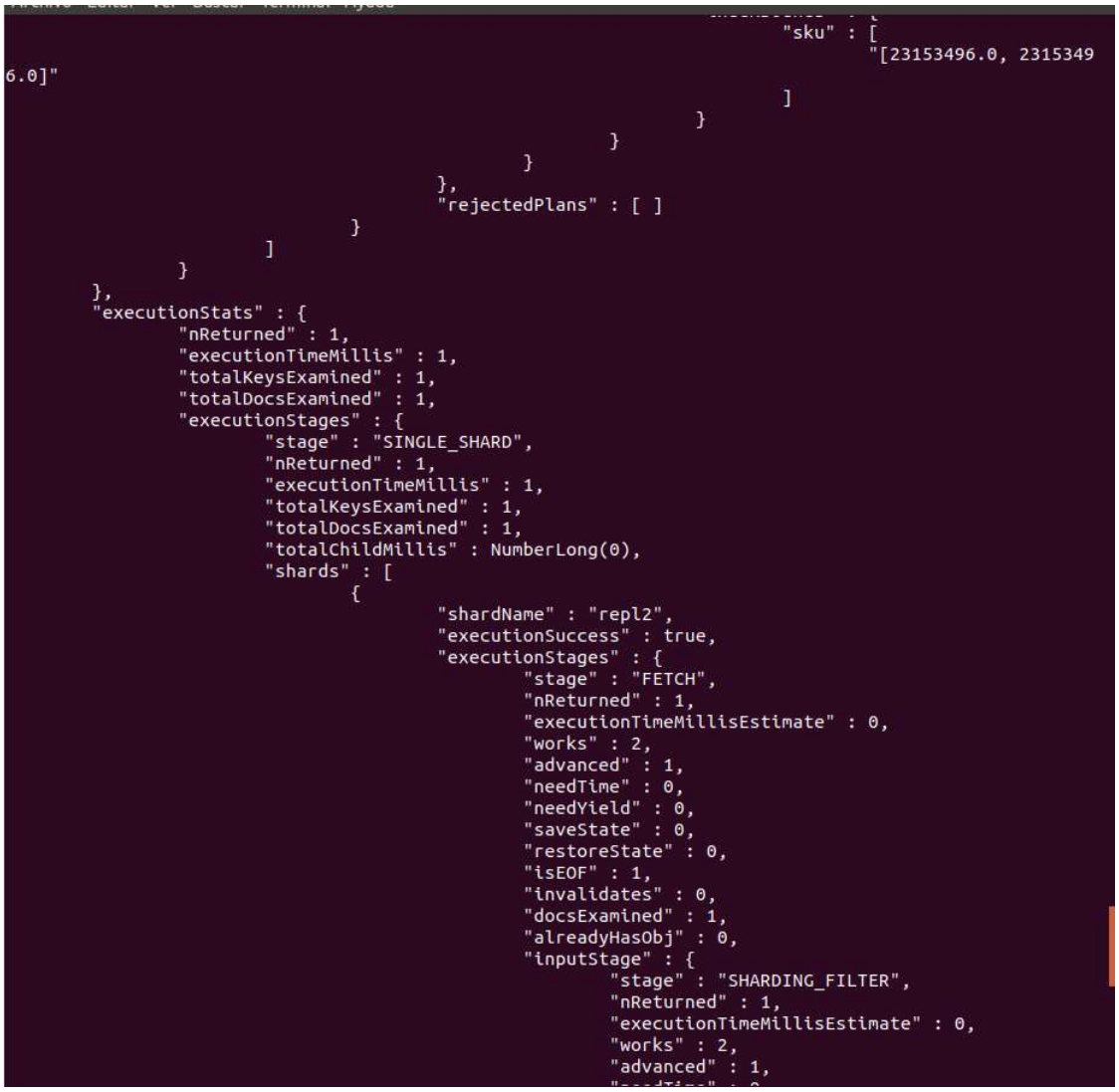
Se crea otro índice: db.products.createIndex({"shippingWeight": 1})

```
}
mongos> db.products.createIndex({"shippingWeight": 1})
{
        "raw" : {
                "repl1/localhost:28111,localhost:28124,localhost:28125" : {
                        "createdCollectionAutomatically" : false,
                        "numIndexesBefore" : 2,
                        "numIndexesAfter" : 3,
                        "ok" : 1
                },
                "repl2/localhost:28121,localhost:28122,localhost:28123" : {
                        "createdCollectionAutomatically" : false,
                        "numIndexesBefore" : 2,
                        "numIndexesAfter" : 3,
                        "ok" : 1
                }
        },
        "ok" : 1,
        "$clusterTime" : {
                "clusterTime" : Timestamp(1578392040, 1),
                "signature" : {
                        "hash" : BinData(0,"TNvM6OB43FklUy2ACz271v95gK4="),
                        "keyId" : NumberLong("6778958857092726787")
                }
        },
        "operationTime" : Timestamp(1578392040, 1)
}
mongos>
```

Se realizan las dos últimas queries con “executionStats”:

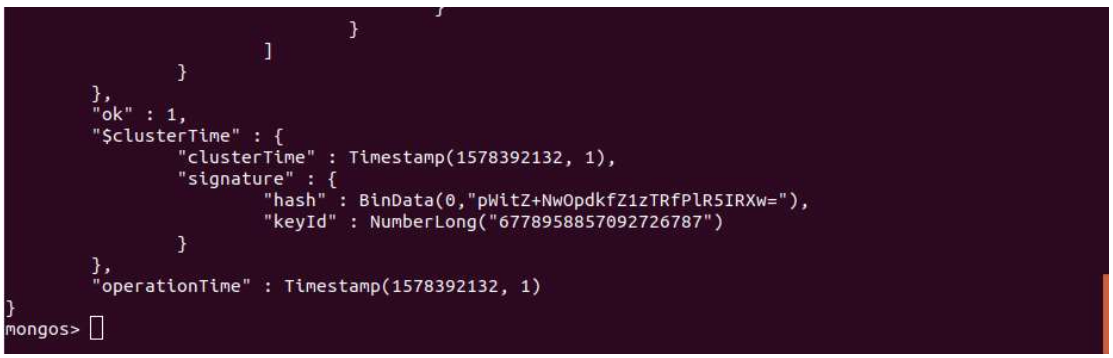
Query 1:

```
mongos> db.products.explain("executionStats").find({"sku": 23153496})
{
        "queryPlanner" : {
                "mongosPlannerVersion" : 1,
                "winningPlan" : {
                        "stage" : "SINGLE_SHARD",
                        "shards" : [
                                {
                                        "shardName" : "repl2",
                                        "connectionString" : "repl2/localhost:28121,localhost:28122,l
ocalhost:28123",
                                        "serverInfo" : {
                                                "host" : "master-BigData",
                                                "port" : 28121,
                                                "version" : "3.6.3",
                                                "gitVersion" : "9586e557d54ef70f9ca4b43c26892cd55257e
1a5"
                                        },
                                        "plannerVersion" : 1,
                                        "namespace" : "shardlesson.products",
                                        "indexFilterSet" : false,
                                        "parsedQuery" : {
                                                "sku" : {
                                                        "$eq" : 23153496
                                                }
                                        },
                                        "winningPlan" : {
                                                "stage" : "FETCH",
                                                "inputStage" : {
                                                        "stage" : "SHARDING_FILTER",
                                                        "inputStage" : {
                                                                "stage" : "IXSCAN",
                                                                "keyPattern" : {
                                                                        "sku" : 1
                                                                },
                                                                "indexName" : "sku_1",
                                                                "isMultiKey" : false,
                                                                "multiKeyPaths" : {
                                                                        "sku" : [ ]
                                                                },
                                                                "isUnique" : false,
                                                                "isSparse" : false,
                                                                "isPartial" : false,
                                                                "indexVersion" : 2,
                                                                "direction" : "forward",
                                                                "indexBounds" : {
                                                                        "sku" : [
                                                                                "[23153496.0, 2315349
6.0]"
                                                                ]
```


"sku" : [
"[23153496.0, 2315349
6.0]"
]
}
}
}
},
"rejectedPlans" : [ ]
}
]
}
},
"executionStats" : {
"nReturned" : 1,
"executionTimeMillis" : 1,
"totalKeysExamined" : 1,
"totalDocsExamined" : 1,
"executionStages" : {
"stage" : "SINGLE_SHARD",
"nReturned" : 1,
"executionTimeMillis" : 1,
"totalKeysExamined" : 1,
"totalDocsExamined" : 1,
"totalChildMillis" : NumberLong(0),
"shards" : [
{
"shardName" : "repl2",
"executionSuccess" : true,
"executionStages" : {
"stage" : "FETCH",
"nReturned" : 1,
"executionTimeMillisEstimate" : 0,
"works" : 2,
"advanced" : 1,
"needTime" : 0,
"needYield" : 0,
"saveState" : 0,
"restoreState" : 0,
"isEOF" : 1,
"invalidates" : 0,
"docsExamined" : 1,
"alreadyHasObj" : 0,
"inputStage" : {
"stage" : "SHARDING_FILTER",
"nReturned" : 1,
"executionTimeMillisEstimate" : 0,
"works" : 2,
"advanced" : 1,

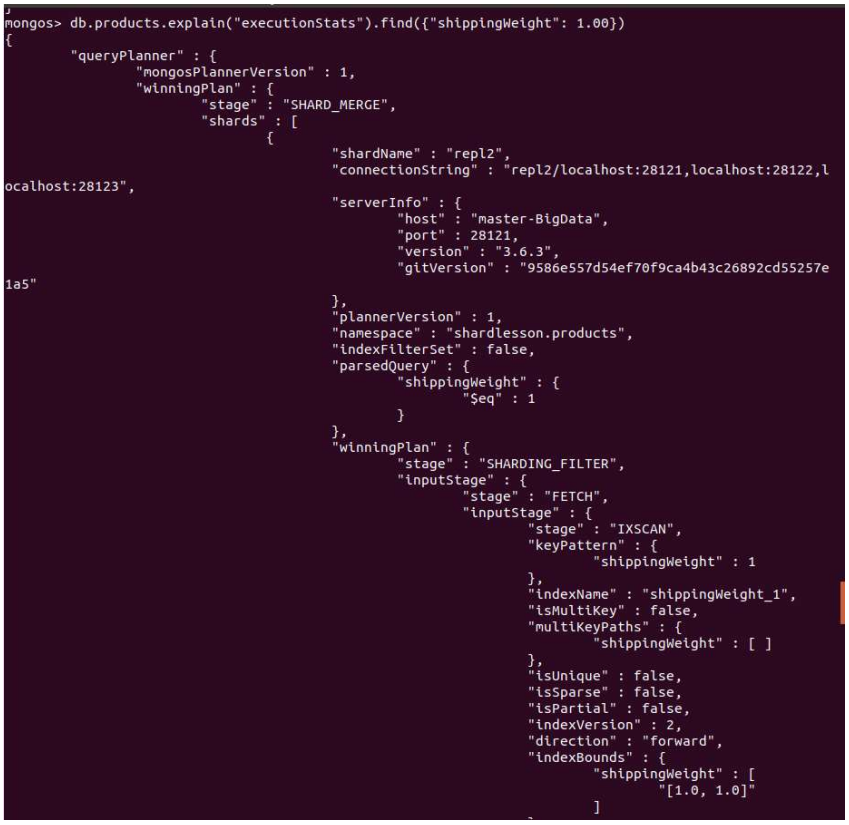
```
                                                "works" : 2,
                                                "advanced" : 1,
                                                "needTime" : 0,
                                                "needYield" : 0,
                                                "saveState" : 0,
                                                "restoreState" : 0,
                                                "isEOF" : 1,
                                                "invalidates" : 0,
                                                "chunkSkips" : 0,
                                                "inputStage" : {
                                                        "stage" : "IXSCAN",
                                                        "nReturned" : 1,
                                                        "executionTimeMillisEstimate" : 0,
                                                        "works" : 2,
                                                        "advanced" : 1,
                                                        "needTime" : 0,
                                                        "needYield" : 0,
                                                        "saveState" : 0,
                                                        "restoreState" : 0,
                                                        "isEOF" : 1,
                                                        "invalidates" : 0,
                                                        "keyPattern" : {
                                                                "sku" : 1
                                                        },
                                                        "indexName" : "sku_1",
                                                        "isMultiKey" : false,
                                                        "multiKeyPaths" : {
                                                                "sku" : [ ]
                                                        },
                                                        "isUnique" : false,
                                                        "isSparse" : false,
                                                        "isPartial" : false,
                                                        "indexVersion" : 2,
                                                        "direction" : "forward",
                                                        "indexBounds" : {
                                                                "sku" : [
                                                                        "[23153496.0, 2315349
6.0]"

                                                                ]
                                                        },
                                                        "keysExamined" : 1,
                                                        "seeks" : 1,
                                                        "dupsTested" : 0,
                                                        "dupsDropped" : 0,
                                                        "seenInvalidated" : 0
                                                }
                                        }
                                }
                        }
                ]
```



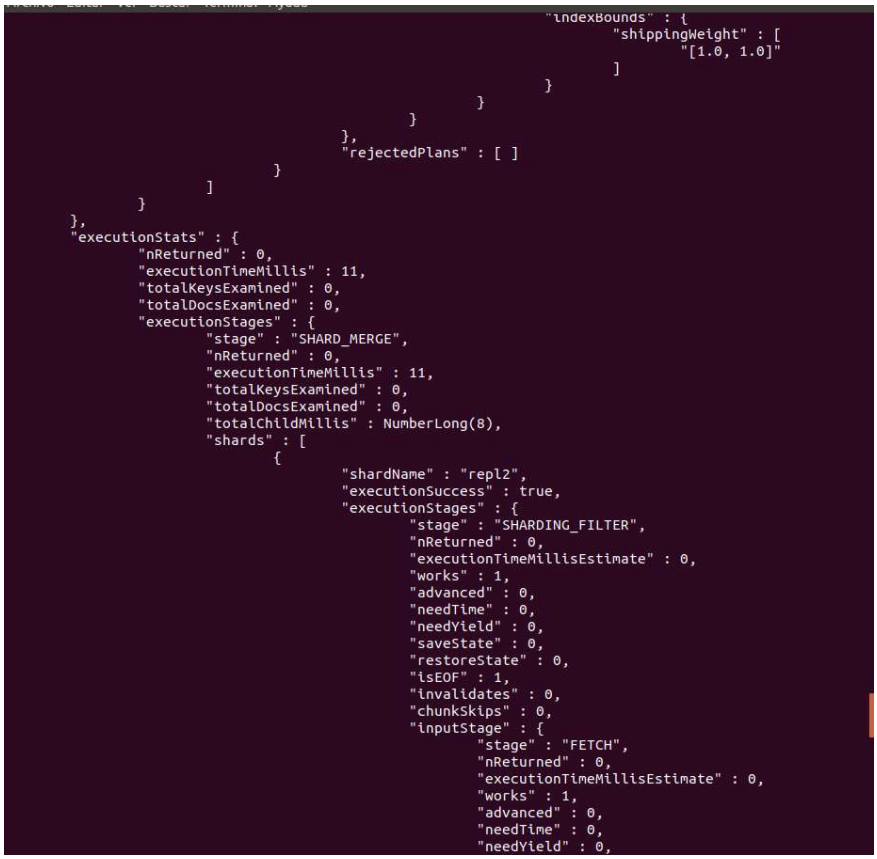
```
                                }
                        }
                ]
        }
},
"ok" : 1,
"$clusterTime" : {
        "clusterTime" : Timestamp(1578392132, 1),
        "signature" : {
                "hash" : BinData(0,"pWitZ+NwOpdkfZ1zTRfPlR5IRXw="),
                "keyId" : NumberLong("6778958857092726787")
        }
},
"operationTime" : Timestamp(1578392132, 1)
}
mongos>
```

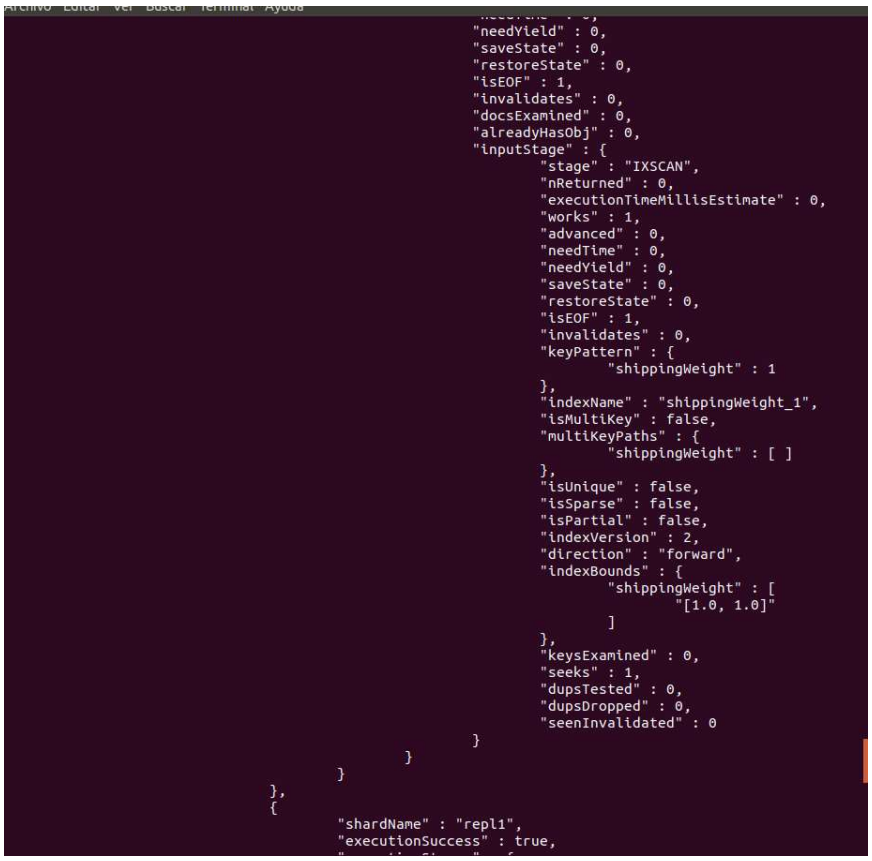
Query 2: db.products.explain("executionStats").find({"shippingWeight": 1.00})

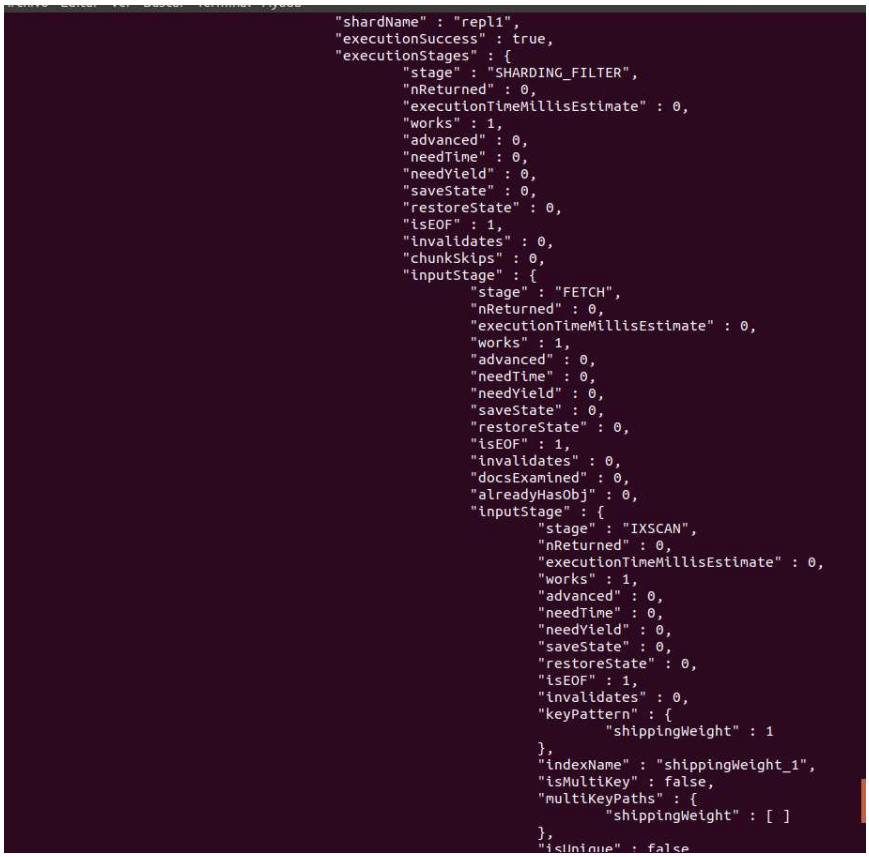


```
mongos> db.products.explain("executionStats").find({"shippingWeight": 1.00})
{
        "queryPlanner" : {
                "mongosPlannerVersion" : 1,
                "winningPlan" : {
                        "stage" : "SHARD_MERGE",
                        "shards" : [
                                {
                                        "shardName" : "repl2",
                                        "connectionString" : "repl2/localhost:28121,localhost:28122,l
ocalhost:28123",
                                        "serverInfo" : {
                                                "host" : "master-BigData",
                                                "port" : 28121,
                                                "version" : "3.6.3",
                                                "gitVersion" : "9586e557d54ef70f9ca4b43c26892cd55257e
1a5"
                                        },
                                        "plannerVersion" : 1,
                                        "namespace" : "shardlesson.products",
                                        "indexFilterSet" : false,
                                        "parsedQuery" : {
                                                "shippingWeight" : {
                                                        "$eq" : 1
                                                }
                                        },
                                        "winningPlan" : {
                                                "stage" : "SHARDING_FILTER",
                                                "inputStage" : {
                                                        "stage" : "FETCH",
                                                        "inputStage" : {
                                                                "stage" : "IXSCAN",
                                                                "keyPattern" : {
                                                                        "shippingWeight" : 1
                                                                },
                                                                "indexName" : "shippingWeight_1",
                                                                "isMultiKey" : false,
                                                                "multiKeyPaths" : {
                                                                        "shippingWeight" : [ ]
                                                                },
                                                                "isUnique" : false,
                                                                "isSparse" : false,
                                                                "isPartial" : false,
                                                                "indexVersion" : 2,
                                                                "direction" : "forward",
                                                                "indexBounds" : {
                                                                        "shippingWeight" : [
                                                                                "[1.0, 1.0]"
                                                                        ]
```

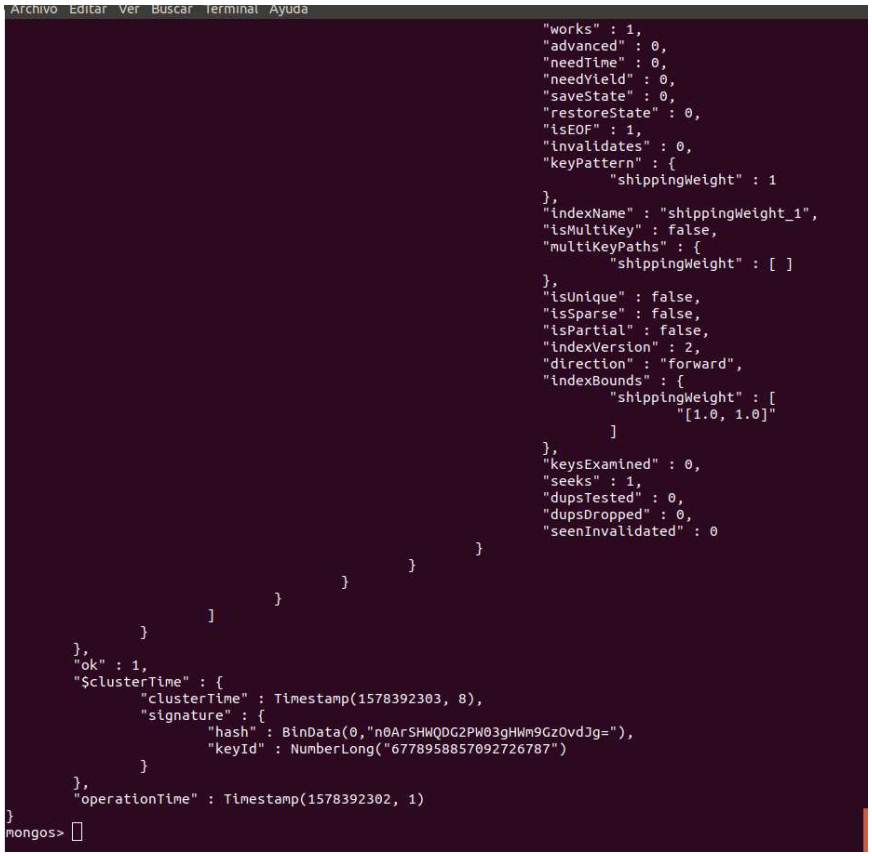
```
                                                                        "shippingWeight" : [
                                                                                "[1.0, 1.0]"
                                                                        ]
                                                                }
                                                        }
                                                }
                                        },
                                        "rejectedPlans" : [ ]
                                },
                                {
                                        "shardName" : "repl1",
                                        "connectionString" : "repl1/localhost:28111,localhost:28124,l
ocalhost:28125",
                                        "serverInfo" : {
                                                "host" : "master-BigData",
                                                "port" : 28111,
                                                "version" : "3.6.3",
                                                "gitVersion" : "9586e557d54ef70f9ca4b43c26892cd55257e
1a5"
                                        },
                                        "plannerVersion" : 1,
                                        "namespace" : "shardlesson.products",
                                        "indexFilterSet" : false,
                                        "parsedQuery" : {
                                                "shippingWeight" : {
                                                        "$eq" : 1
                                                }
                                        },
                                        "winningPlan" : {
                                                "stage" : "SHARDING_FILTER",
                                                "inputStage" : {
                                                        "stage" : "FETCH",
                                                        "inputStage" : {
                                                                "stage" : "IXSCAN",
                                                                "keyPattern" : {
                                                                        "shippingWeight" : 1
                                                                },
                                                                "indexName" : "shippingWeight_1",
                                                                "isMultiKey" : false,
                                                                "multiKeyPaths" : {
                                                                        "shippingWeight" : [ ]
                                                                },
                                                                "isUnique" : false,
                                                                "isSparse" : false,
                                                                "isPartial" : false,
                                                                "indexVersion" : 2,
                                                                "direction" : "forward",
                                                                "indexBounds" : {
                                                                        "shippingWeight" : [
```


"indexBounds" : {
"shippingWeight" : [
"[1.0, 1.0]"
]
}
}
}
},
"rejectedPlans" : [ ]
}
]
}
},
"executionStats" : {
"nReturned" : 0,
"executionTimeMillis" : 11,
"totalKeysExamined" : 0,
"totalDocsExamined" : 0,
"executionStages" : {
"stage" : "SHARD_MERGE",
"nReturned" : 0,
"executionTimeMillis" : 11,
"totalKeysExamined" : 0,
"totalDocsExamined" : 0,
"totalChildMillis" : NumberLong(8),
"shards" : [
{
"shardName" : "repl2",
"executionSuccess" : true,
"executionStages" : {
"stage" : "SHARDING_FILTER",
"nReturned" : 0,
"executionTimeMillisEstimate" : 0,
"works" : 1,
"advanced" : 0,
"needTime" : 0,
"needYield" : 0,
"saveState" : 0,
"restoreState" : 0,
"isEOF" : 1,
"invalidates" : 0,
"chunkSkips" : 0,
"inputStage" : {
"stage" : "FETCH",
"nReturned" : 0,
"executionTimeMillisEstimate" : 0,
"works" : 1,
"advanced" : 0,
"needTime" : 0,
"needYield" : 0,


"needYield" : 0,
"saveState" : 0,
"restoreState" : 0,
"isEOF" : 1,
"invalidates" : 0,
"docsExamined" : 0,
"alreadyHasObj" : 0,
"inputStage" : {
"stage" : "IXSCAN",
"nReturned" : 0,
"executionTimeMillisEstimate" : 0,
"works" : 1,
"advanced" : 0,
"needTime" : 0,
"needYield" : 0,
"saveState" : 0,
"restoreState" : 0,
"isEOF" : 1,
"invalidates" : 0,
"keyPattern" : {
"shippingWeight" : 1
},
"indexName" : "shippingWeight_1",
"isMultiKey" : false,
"multiKeyPaths" : {
"shippingWeight" : [ ]
},
"isUnique" : false,
"isSparse" : false,
"isPartial" : false,
"indexVersion" : 2,
"direction" : "forward",
"indexBounds" : {
"shippingWeight" : [
"[1.0, 1.0]"
]
},
"keysExamined" : 0,
"seeks" : 1,
"dupsTested" : 0,
"dupsDropped" : 0,
"seenInvalidated" : 0
}
}
}
},
{
"shardName" : "repl1",
"executionSuccess" : true,



```
                                        "shardName" : "repl1",
                                        "executionSuccess" : true,
                                        "executionStages" : {
                                                "stage" : "SHARDING_FILTER",
                                                "nReturned" : 0,
                                                "executionTimeMillisEstimate" : 0,
                                                "works" : 1,
                                                "advanced" : 0,
                                                "needTime" : 0,
                                                "needYield" : 0,
                                                "saveState" : 0,
                                                "restoreState" : 0,
                                                "isEOF" : 1,
                                                "invalidates" : 0,
                                                "chunkSkips" : 0,
                                                "inputStage" : {
                                                        "stage" : "FETCH",
                                                        "nReturned" : 0,
                                                        "executionTimeMillisEstimate" : 0,
                                                        "works" : 1,
                                                        "advanced" : 0,
                                                        "needTime" : 0,
                                                        "needYield" : 0,
                                                        "saveState" : 0,
                                                        "restoreState" : 0,
                                                        "isEOF" : 1,
                                                        "invalidates" : 0,
                                                        "docsExamined" : 0,
                                                        "alreadyHasObj" : 0,
                                                        "inputStage" : {
                                                                "stage" : "IXSCAN",
                                                                "nReturned" : 0,
                                                                "executionTimeMillisEstimate" : 0,
                                                                "works" : 1,
                                                                "advanced" : 0,
                                                                "needTime" : 0,
                                                                "needYield" : 0,
                                                                "saveState" : 0,
                                                                "restoreState" : 0,
                                                                "isEOF" : 1,
                                                                "invalidates" : 0,
                                                                "keyPattern" : {
                                                                        "shippingWeight" : 1
                                                                },
                                                                "indexName" : "shippingWeight_1",
                                                                "isMultiKey" : false,
                                                                "multiKeyPaths" : {
                                                                        "shippingWeight" : [ ]
                                                                },
                                                                "isUnique" : false,
```



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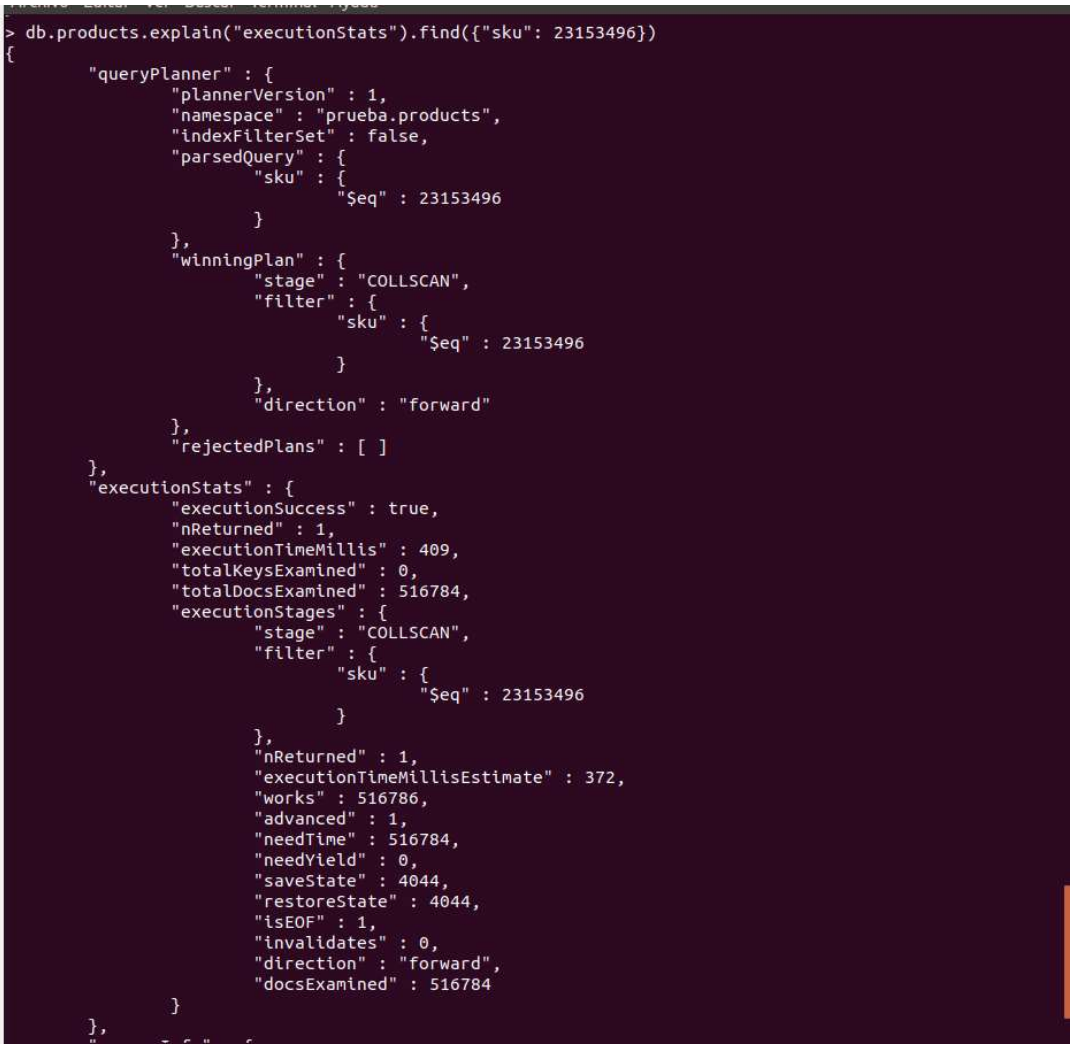
                                                                "works" : 1,
                                                                "advanced" : 0,
                                                                "needTime" : 0,
                                                                "needYield" : 0,
                                                                "saveState" : 0,
                                                                "restoreState" : 0,
                                                                "isEOF" : 1,
                                                                "invalidates" : 0,
                                                                "keyPattern" : {
                                                                        "shippingWeight" : 1
                                                                },
                                                                "indexName" : "shippingWeight_1",
                                                                "isMultiKey" : false,
                                                                "multiKeyPaths" : {
                                                                        "shippingWeight" : [ ]
                                                                },
                                                                "isUnique" : false,
                                                                "isSparse" : false,
                                                                "isPartial" : false,
                                                                "indexVersion" : 2,
                                                                "direction" : "forward",
                                                                "indexBounds" : {
                                                                        "shippingWeight" : [
                                                                                "[1.0, 1.0]"
                                                                        ]
                                                                },
                                                                "keysExamined" : 0,
                                                                "seeks" : 1,
                                                                "dupsTested" : 0,
                                                                "dupsDropped" : 0,
                                                                "seenInvalidated" : 0
                                                        }
                                                }
                                        }
                                ]
                        }
                },
                "ok" : 1,
                "$clusterTime" : {
                        "clusterTime" : Timestamp(1578392303, 8),
                        "signature" : {
                                "hash" : BinData(0,"n0ArSHWQDG2PW03gHWm9GzOvdJg="),
                                "keyId" : NumberLong("6778958857092726787")
                        }
                },
                "operationTime" : Timestamp(1578392302, 1)
}
mongos>
```

Por último, vamos a realizar las mismas queries sin el shard cluster.

1 query



```
> db.products.explain("executionStats").find({"sku": 23153496})
{
        "queryPlanner" : {
                "plannerVersion" : 1,
                "namespace" : "prueba.products",
                "indexFilterSet" : false,
                "parsedQuery" : {
                        "sku" : {
                                "$eq" : 23153496
                        }
                },
                "winningPlan" : {
                        "stage" : "COLLSCAN",
                        "filter" : {
                                "sku" : {
                                        "$eq" : 23153496
                                }
                        },
                        "direction" : "forward"
                },
                "rejectedPlans" : [ ]
        },
        "executionStats" : {
                "executionSuccess" : true,
                "nReturned" : 1,
                "executionTimeMillis" : 409,
                "totalKeysExamined" : 0,
                "totalDocsExamined" : 516784,
                "executionStages" : {
                        "stage" : "COLLSCAN",
                        "filter" : {
                                "sku" : {
                                        "$eq" : 23153496
                                }
                        },
                        "nReturned" : 1,
                        "executionTimeMillisEstimate" : 372,
                        "works" : 516786,
                        "advanced" : 1,
                        "needTime" : 516784,
                        "needYield" : 0,
                        "saveState" : 4044,
                        "restoreState" : 4044,
                        "isEOF" : 1,
                        "invalidates" : 0,
                        "direction" : "forward",
                        "docsExamined" : 516784
                }
        },
```

```
                        "docsExamined" : 516784
                }
        },
        "serverInfo" : {
                "host" : "master-BigData",
                "port" : 30000,
                "version" : "3.6.3",
                "gitVersion" : "9586e557d54ef70f9ca4b43c26892cd55257e1a5"
        },
        "ok" : 1
}
>
```

2 query:

```
Archivo  Editar  Ver  Buscar  Terminal  Ayuda
}
> db.products.explain("executionStats").find({"shippingWeight": 1.00})
{
        "queryPlanner" : {
                "plannerVersion" : 1,
                "namespace" : "prueba.products",
                "indexFilterSet" : false,
                "parsedQuery" : {
                        "shippingWeight" : {
                                "$eq" : 1
                        }
                },
                "winningPlan" : {
                        "stage" : "COLLSCAN",
                        "filter" : {
                                "shippingWeight" : {
                                        "$eq" : 1
                                }
                        },
                        "direction" : "forward"
                },
                "rejectedPlans" : [ ]
        },
        "executionStats" : {
                "executionSuccess" : true,
                "nReturned" : 0,
                "executionTimeMillis" : 370,
                "totalKeysExamined" : 0,
                "totalDocsExamined" : 516784,
                "executionStages" : {
                        "stage" : "COLLSCAN",
                        "filter" : {
                                "shippingWeight" : {
                                        "$eq" : 1
                                }
                        },
                        "nReturned" : 0,
                        "executionTimeMillisEstimate" : 309,
                        "works" : 516786,
                        "advanced" : 0,
                        "needTime" : 516785,
                        "needYield" : 0,
                        "saveState" : 4042,
                        "restoreState" : 4042,
                        "isEOF" : 1,
                        "invalidates" : 0,
                        "direction" : "forward",
                        "docsExamined" : 516784
                }
```

```
                        "direction" : "forward",
                        "docsExamined" : 516784
                }
        },
        "serverInfo" : {
                "host" : "master-BigData",
                "port" : 30000,
                "version" : "3.6.3",
                "gitVersion" : "9586e557d54ef70f9ca4b43c26892cd55257e1a5"
        },
        "ok" : 1
}
>
```