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We need to first generate random articles/videos inside folder 'db' by executing *db/genTable_mongoDB.py*

```
python db/genTable_mongoDB.py
```

Note：we need to open a new terminal whenever we need to turn on a Mongos/Mongod server because once a server is started, it will run forever until we close the terminal so we cannot issue any subsequent command on this terminal.

1. Start 4 mongods servers by the following commands. Note that we can use any address for --dbpath.
   We need to open a new terminal once a mongod server is started：

   ```
   mongod --port 5000 --dbpath D:\MongoDB\proj-ddbms\repl_1 --noauth --replSet proj --shardsvr
   ```

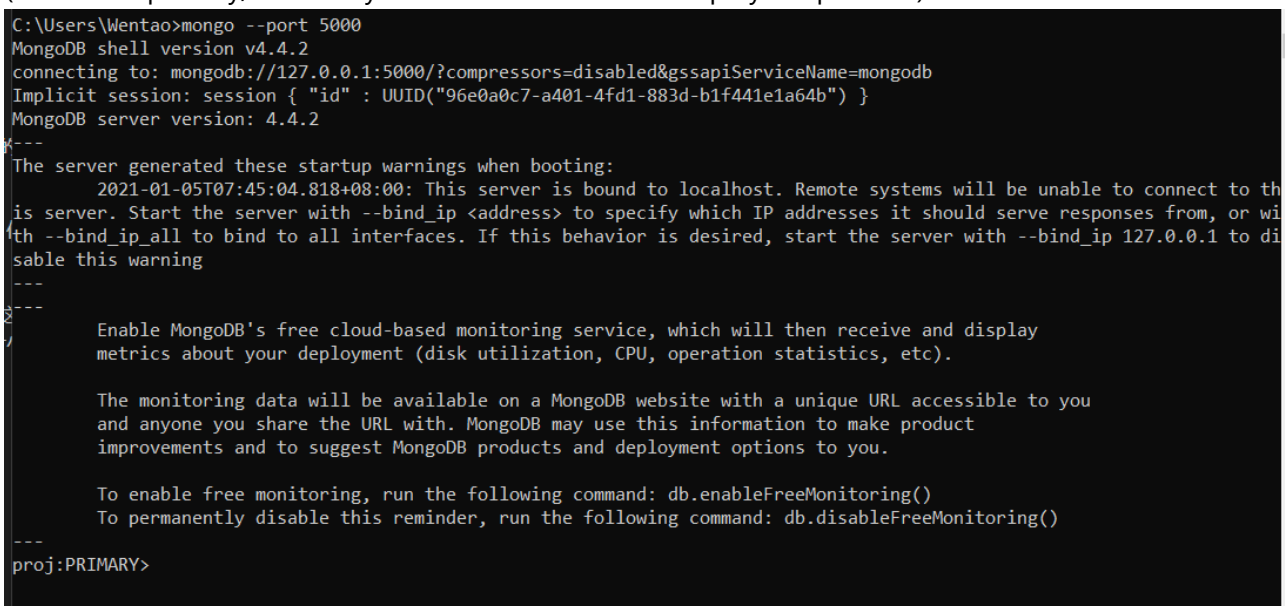
   ```
   mongod --port 5001 --dbpath D:\MongoDB\proj-ddbms\repl_2 --noauth --replSet proj --shardsvr
   ```

   ```
   mongod --port 5002 --dbpath D:\MongoDB\proj-ddbms\repl_3 --noauth --replSet proj --shardsvr
   ```

   ```
   mongod --port 5003 --dbpath D:\MongoDB\proj-ddbms\repl_4 --noauth --replSet proj --shardsvr
   ```

2. Check if our server is started by typing `mongo --port 5000` in terminal.

   (The word "primary/secondary" will be shown after we deploy a replica set)

   We then type the following commands in this shell

```
use admin

rs.initiate()

rs.add('localhost:5001)

rs.add('localhost:5002)

rs.addArb('localhost:5003)
```

3. Deploy a config server (**We also need to open a terminal for each commd in the first 3 lines. The later 5 commands are executed in the same terminal**):

```
mongod --port 6000 --dbpath D:\MongoDB\proj-ddbms\cfg_1 --noauth --configsvr --
replSet projCfg

mongod --port 6001 --dbpath D:\MongoDB\proj-ddbms\cfg_2 --noauth --configsvr --
replSet projCfg

mongod --port 6002 --dbpath D:\MongoDB\proj-ddbms\cfg_3 --noauth --configsvr --
replSet projCfg

mongo --port 6000

use admin

rs.initiate()

rs.add('localhost:6001)

rs.add('localhost:6002)
```

4. Deploy a router (**We also need to open a terminal for the first command**)

```
mongos --configdb projCfg/localhost:6000,localhost:6001,localhost:6002 --port 1000
```

We execute these 3 commands in one terminal.

```
mongo --port 1000

use admin

db.runCommand({addshard:"proj/localhost:5000,localhost:5001,localhost:5002,localhos
t:5003"})
```

5. We need to create a new replica set for DBMS2.

```
mongod --port 7000 --dbpath D:\MongoDB\proj-ddbms2\repl_1 --noauth --replSet proj2
--shardsvr

mongod --port 7001 --dbpath D:\MongoDB\proj-ddbms2\repl_2 --noauth --replSet proj2
--shardsvr

mongod --port 7002 --dbpath D:\MongoDB\proj-ddbms2\repl_3 --noauth --replSet proj2
--shardsvr
```

The following 5 commands are executed in one terminal.

```
mongo --port 7000

use admin

rs.initiate()

rs.add('localhost:7001)

rs.add('localhost:7002)
```

--end--

These 3 commands are executed in 3 different terminals.

```
mongod --port 8000 --dbpath D:\MongoDB\proj-ddbms2\cfg_1 --noauth --configsvr

mongod --port 8001 --dbpath D:\MongoDB\proj-ddbms2\cfg_2 --noauth --configsvr

mongod --port 8002 --dbpath D:\MongoDB\proj-ddbms2\cfg_3 --noauth --configsvr
```

The following 5 commands are executed in one terminal.

```
mongo --port 8000

use admin

rs.initiate()

rs.add('localhost:8001)

rs.add('localhost:8002)
```

--end--

Again, open a new terminal.

```
mongos --configdb proj2Cfg/localhost:8000,localhost:8001,localhost:8002 --port 2000
```

These 3 commands are executed in 3 different terminals.

```
mongo --port 2000

use admin

db.runCommand({addshard:"proj2/localhost:7000,localhost:7001,localhost:7002"})
```

--end--

6. Start *redis-server.exe* and make sure the port is set as default (port# 6379)
7. Open $HADOOP_HOME/sbin folder， run *start-all.sh* on macOS/Linux or *start-all.cmd* on Windows.

Don't change the sequence of the running scripts

9. `python readraw.py` to insert documents into User/Article/Read table
10. `python main.py` to perform some queries on User/Article/Read table with/without join
11. `python pop_rank_demo.py` to do pop_rank / be_read computations + download Top-5 Read Articles from HDFS
12. `python server_status_demo.py` do a demo of logging server status
13. `python migrate.py` do a demo of data migration to another data center at runtime
14. `python new_server_demo.py` do a demo of adding a new server to existing data center at runtime
15. `python drop_server.py` do a demo of dropping a secondary-node server at runtime

---

Tips

- To test if mongod is on: ```mongo --port [port number]```

```
C:\Users\Wentao>mongo --port 5000
MongoDB shell version v4.4.2
connecting to: mongodb://127.0.0.1:5000/?compressors=disabled&gssapiServiceName=mongodb
Implicit session: session { "id" : UUID("96e0a0c7-a401-4fd1-883d-b1f441e1a64b") }
MongoDB server version: 4.4.2
---
The server generated these startup warnings when booting:
        2021-01-05T07:45:04.818+08:00: This server is bound to localhost. Remote systems will be unable to connect to th
is server. Start the server with --bind_ip <address> to specify which IP addresses it should serve responses from, or wi
th --bind_ip_all to bind to all interfaces. If this behavior is desired, start the server with --bind_ip 127.0.0.1 to di
sable this warning
---
---
        Enable MongoDB's free cloud-based monitoring service, which will then receive and display
        metrics about your deployment (disk utilization, CPU, operation statistics, etc).

        The monitoring data will be available on a MongoDB website with a unique URL accessible to you
        and anyone you share the URL with. MongoDB may use this information to make product
        improvements and to suggest MongoDB products and deployment options to you.

        To enable free monitoring, run the following command: db.enableFreeMonitoring()
        To permanently disable this reminder, run the following command: db.disableFreeMonitoring()
---
proj:PRIMARY>
```

- To add a datanode is successfully to an existing replica set: open mongo shell on any running server of this replica set:

```
mongo --port [running port number]

use admin

rs.add('localhost:[new datanode port number]')
```

```
proj:PRIMARY> use admin
switched to db admin
proj:PRIMARY> rs.add('localhost:5004')
{
        "ok" : 1,
        "$gleStats" : {
                "lastOpTime" : {
                        "ts" : Timestamp(1609815042, 1),
                        "t" : NumberLong(37)
                },
                "electionId" : ObjectId("7fffffff0000000000000025")
        },
        "lastCommittedOpTime" : Timestamp(1609809744, 2),
        "$configServerState" : {
                "opTime" : {
                        "ts" : Timestamp(1609815040, 1),
                        "t" : NumberLong(28)
                }
        },
        "$clusterTime" : {
                "clusterTime" : Timestamp(1609815046, 1),
                "signature" : {
                        "hash" : BinData(0,"AAAAAAAAAAAAAAAAAAAAAAAAAAA="),
                        "keyId" : NumberLong(0)
                }
        },
        "operationTime" : Timestamp(1609815042, 1)
}
proj:PRIMARY>
```

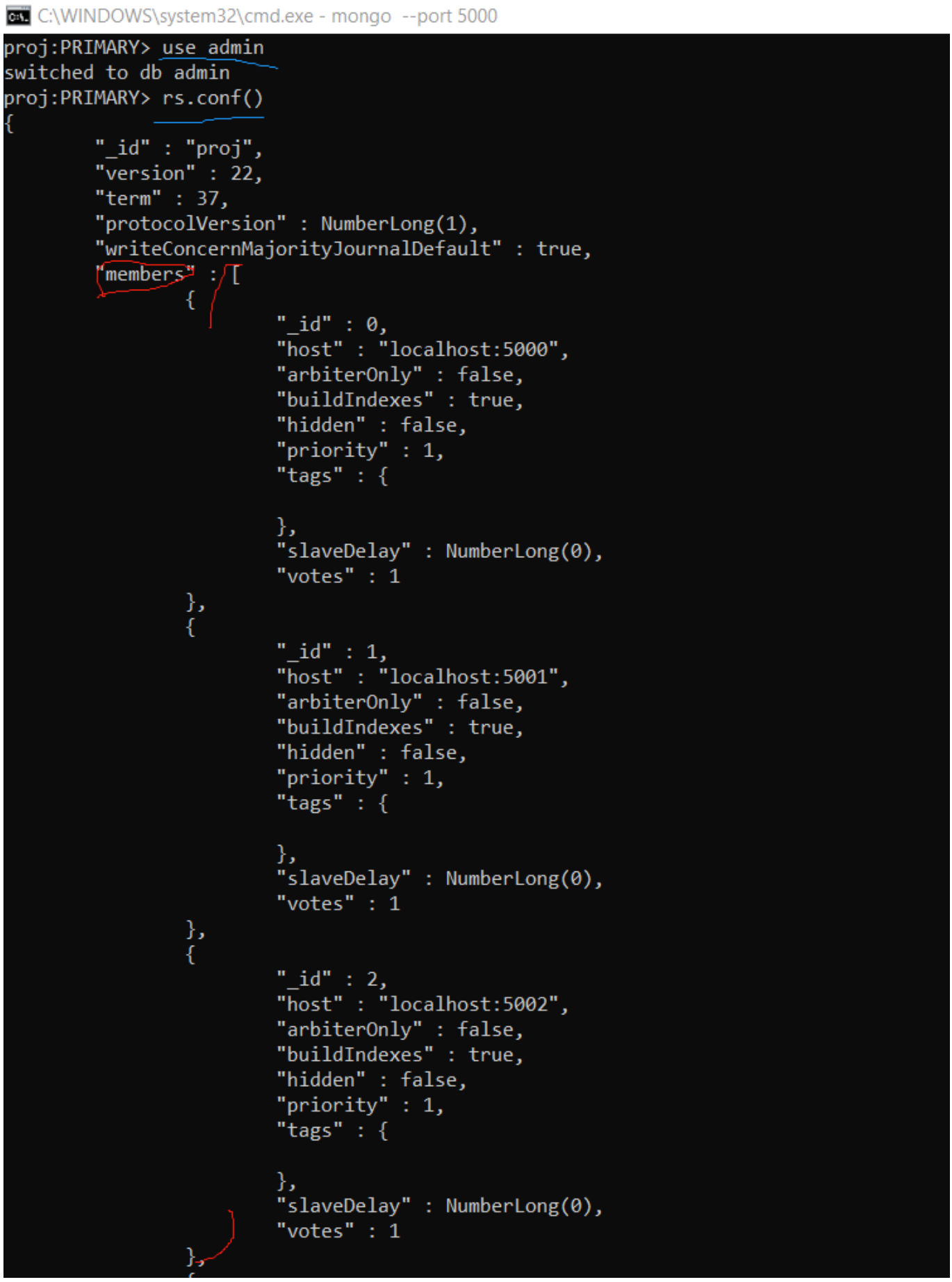
'ok' == 1 means success

- Check a datanode status in mongo shell：

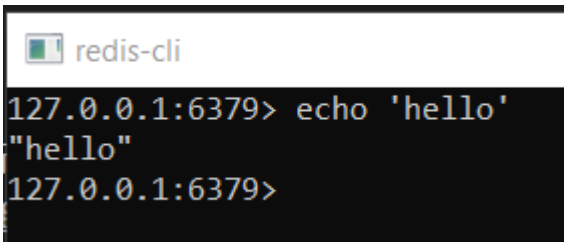
```
use admin

rs.conf()
```

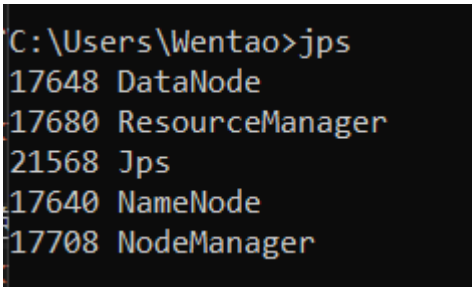
and we lookup the wanted host number in the 'members' field



- Test if redis server is on： start redis-cli.exe (redis shell) and command `echo 'hello world'`



- Test if HDFS is on： command ```jps``` in terminal, and if DataNode / ResourceManager / NameNode / NodeManager are all shown, we know our HDFS is still working



Note：we can upload any files/directories into HDFS by executing `hdfs dfs -put [src addr] [dst addr]`, but I also create a jar file ('proj.jar') to faciliate uploading all files in *db/articles*. This implementation leverages multi-threads and prints current progress for every 10 seconds. Its source code can be found in *Main.java*. We only need to simply command `hadoop jar proj.jar` in terminal.