

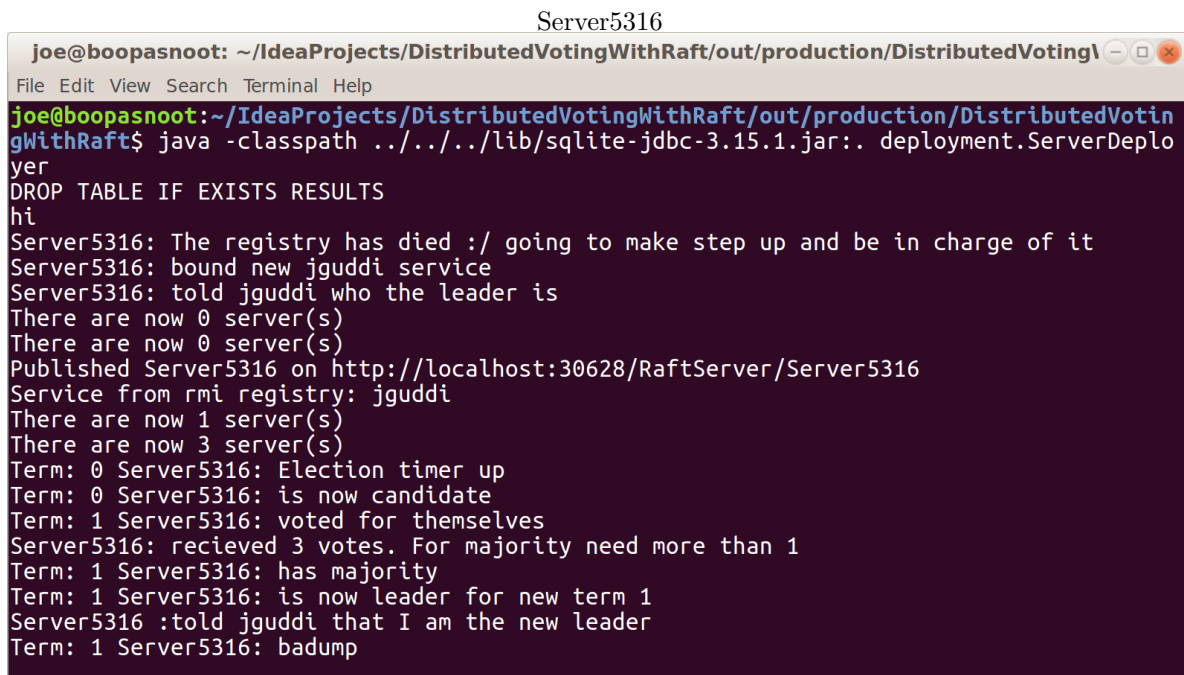
Use Cases

Here we present 5 different sets of screen shots demonstrating different stages of a use of the distributed voting service. The client can choose to repeatedly vote for one of four people or request a printout of the current standings. These use cases demonstrate the high availability of our service, and how the client is for all intent and purpose unaware of what is going on server side.

Leader Election

In the below set of terminals 3 servers were started almost instantaneously. It is evident how Server5316 can't find an instance of the jgUDDI service registry is not present so it starts it. It publishes its self and then before its election timer runs out it has identified that two other servers have been started. Its election timer then runs out and it becomes a candidate, requests votes, receives votes and then becomes the new leader. "Badump" indicates that it is sending heart beat messages.

Server5316



```
joe@boopasnoot: ~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVoting
File Edit View Search Terminal Help
joe@boopasnoot:~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVotingWithRaft$ java -classpath ../../lib/sqlite-jdbc-3.15.1.jar:. deployment.ServerDeployer
DROP TABLE IF EXISTS RESULTS
hi
Server5316: The registry has died :/ going to make step up and be in charge of it
Server5316: bound new jguddi service
Server5316: told jguddi who the leader is
There are now 0 server(s)
There are now 0 server(s)
Published Server5316 on http://localhost:30628/RaftServer/Server5316
Service from rmi registry: jguddi
There are now 1 server(s)
There are now 3 server(s)
Term: 0 Server5316: Election timer up
Term: 0 Server5316: is now candidate
Term: 1 Server5316: voted for themselves
Server5316: recieved 3 votes. For majority need more than 1
Term: 1 Server5316: has majority
Term: 1 Server5316: is now leader for new term 1
Server5316 :told jguddi that I am the new leader
Term: 1 Server5316: badump
```

It is evident in the other two terminals (Server9547 and Server5810) that they find the jgUDDI service hosted by Server5316, vote for Server5316 and then start to receive heart beat messages from Server5316. If a client was to vote, the transaction log would be embedded in the heart beat message.

Server9547

```
joe@boopasnoot: ~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVoting
File Edit View Search Terminal Help
joe@boopasnoot:~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVotingWithRaft$ java -classpath ../../lib/sqlite-jdbc-3.15.1.jar:. deployment.ServerDeployer
DROP TABLE IF EXISTS RESULTS
hi
There are now 1 server(s)
There are now 2 server(s)
Published Server9547 on http://localhost:32064/RaftServer/Server9547
Service from rmi registry: jguddi
Server5316 is asking Server9547 to vote for them
Term: 1 Server9547: voted for Server5316
There are now 3 server(s)
Term: 1 Server9547: recieved the heart beat from Server5316
There are now 3 server(s)
Term: 1 Server9547: recieved the heart beat from Server5316
There are now 3 server(s)
Term: 1 Server9547: recieved the heart beat from Server5316
Term: 1 Server9547: recieved the heart beat from Server5316
There are now 3 server(s)
Term: 1 Server9547: recieved the heart beat from Server5316
Term: 1 Server9547: recieved the heart beat from Server5316
There are now 3 server(s)
```

Server5810

```
joe@boopasnoot: ~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVoting
File Edit View Search Terminal Help
joe@boopasnoot:~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVotingWithRaft$ java -classpath ../../lib/sqlite-jdbc-3.15.1.jar:. deployment.ServerDeployer
DROP TABLE IF EXISTS RESULTS
hi
There are now 1 server(s)
There are now 1 server(s)
Published Server5810 on http://localhost:39080/RaftServer/Server5810
Service from rmi registry: jguddi
There are now 3 server(s)
Server5316 is asking Server5810 to vote for them
Term: 1 Server5810: voted for Server5316
There are now 3 server(s)
Term: 1 Server5810: recieved the heart beat from Server5316
There are now 3 server(s)
Term: 1 Server5810: recieved the heart beat from Server5316
Term: 1 Server5810: recieved the heart beat from Server5316
There are now 3 server(s)
Term: 1 Server5810: recieved the heart beat from Server5316
Term: 1 Server5810: recieved the heart beat from Server5316
There are now 3 server(s)
Term: 1 Server5810: recieved the heart beat from Server5316
```

Client Interaction

Here we present two terminals, a follower and the client. The client has made three votes and then requested the current standings. The client always votes to the current leader which is Server2538.

Client

```
joe@boopasnoot: ~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVotingWithRaft
File Edit View Search Terminal Help
joe@boopasnoot:~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVotingWithRaft$ java client.Client
Enter "print" or a name to vote for from: Mary, Jacinta, Niamh, Holly
Mary
Client attempting to vote for: Mary
Voting to this endpoint: http://localhost:43389/RaftServer/Server2538?wsdl
vote cast for Mary
Enter a name to vote for from: Mary, Jacinta, Niamh, Holly
Mary
Client attempting to vote for: Mary
Voting to this endpoint: http://localhost:43389/RaftServer/Server2538?wsdl
vote cast for Mary
Enter a name to vote for from: Mary, Jacinta, Niamh, Holly
Niamh
Client attempting to vote for: Niamh
Voting to this endpoint: http://localhost:43389/RaftServer/Server2538?wsdl
vote cast for Niamh
Enter a name to vote for from: Mary, Jacinta, Niamh, Holly
print
Client Requesting current votes
Voting to this endpoint: http://localhost:43389/RaftServer/Server2538?wsdl
Current Stats:
Mary: 2 votes
Jacinta: 0 votes
Niamh: 1 votes
Holly: 0 votes
```

The servers terminal shows the recieved heart beats, the continued checks for other servers from the jgUDDI service and the vote data which gets passed to the coordinator.

Server8036

```
joe@boopasnoot: ~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVotingWithRaft
File Edit View Search Terminal Help
There are now 3 server(s)
Term: 0 Server8036: recieved the heart beat from Server2538
Term: 0 Server8036: recieved the heart beat from Server2538
There are now 3 server(s)
Term: 0 Server8036: recieved the heart beat from Server2538
There are now 3 server(s)
Term: 0 Server8036: recieved the heart beat from Server2538
Term: 0 Server8036: recieved the heart beat from Server2538
There are now 3 server(s)
Term: 0 Server8036: recieved the heart beat from Server2538
Term: 0 Server8036: recieved the heart beat from Server2538
There are now 3 server(s)
Term: 0 Server8036: recieved the heart beat from Server2538
Server8036adding this data to staging area: Mary,
Adding these votes to db: Mary,
Term: 0 Server8036: recieved the heart beat from Server2538
Server8036adding this data to staging area: Mary,
There are now 3 server(s)
Term: 0 Server8036: recieved the heart beat from Server2538
Server8036adding this data to staging area: Mary,Mary,
Adding these votes to db: Mary,
Term: 0 Server8036: recieved the heart beat from Server2538
```

Leader Crash

The following terminal shows that Server234's reaction to a leader crash. Server234 restarted jgUDDI and repopulated it with current information and removed the dead endpoint (that belonged to the old leader that crashed). It then requests votes and although there is an initial "blip" in service it eventually gets the needed votes to become the new leader and starts sending out heart beat messages. The downtime of the service was minimal.

Server234

```
joe@boopasnoot: ~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVoting\ - □ ×
File Edit View Search Terminal Help
Term: 0 Server234: recieved the heart beat from Server7472
There are now 3 server(s)
Term: 0 Server234: recieved the heart beat from Server7472
Server234: The registry has died :/ going to make step up and be in charge of it
Server234: bound new jguddi service
Server234: told jguddi who the leader is
Web service no longer exists, must be dead
Removing Dead Endpoint http://localhost:33487/RaftServer/Server7472
There are now 2 server(s)
There are now 2 server(s)
Term: 0 Server234: Election timer up
Term: 0 Server234: is now candidate
Server234: recieved 0 votes. For majority need more than 0
There are now 2 server(s)
There are now 2 server(s)
Term: 1 Server234: Election timer up
Term: 1 Server234: is now candidate
Term: 2 Server234: voted for themselves
Server234: recieved 2 votes. For majority need more than 1
Term: 2 Server234: has majority
Term: 2 Server234: is now leader for new term 2
Server234 :told jguddi that I am the new leader
There are now 2 server(s)
Term: 2 Server234: badump
Term: 2 Server234: knows that Server7403 recieved the heart beat
```

During the switchover Server7403 attempts to become the new leader but failed. It ultimately votes for Server234 and becomes its follower.

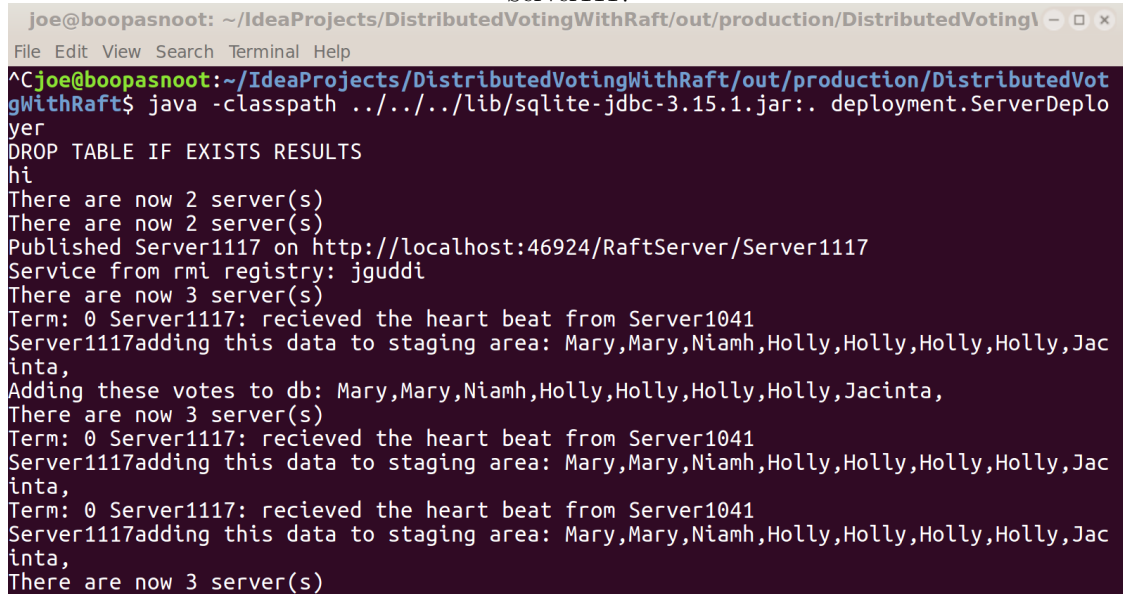
Server7403

```
joe@boopasnoot: ~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVoting\ - □ ×
File Edit View Search Terminal Help
There are now 3 server(s)
Term: 0 Server7403: recieved the heart beat from Server7472
There are now 3 server(s)
Term: 0 Server7403: recieved the heart beat from Server7472
Term: 0 Server7403: recieved the heart beat from Server7472
There are now 3 server(s)
Term: 0 Server7403: recieved the heart beat from Server7472
There are now 2 server(s)
There are now 2 server(s)
Term: 0 Server7403: Election timer up
Term: 0 Server7403: is now candidate
Term: 1 Server7403: voted for themselves
Server7403: recieved 1 votes. For majority need more than 1
There are now 2 server(s)
There are now 2 server(s)
Server234 is asking Server7403 to vote for them
Term: 2 Server7403: voted for Server234
Term: 2 Server7403: recieved the heart beat from Server234
There are now 2 server(s)
Term: 2 Server7403: recieved the heart beat from Server234
There are now 2 server(s)
Term: 2 Server7403: recieved the heart beat from Server234
```

New Server Coming Online

Here we present the output of a server that was brought online at a later time to the service start time. Many votes have been cast at this point. The new server is instantly updated with the latest transaction log from the current leader (Server1041) and it updates its database accordingly.

Server1117



```
joe@boopasnoot: ~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVotingWithRaft
File Edit View Search Terminal Help
^Cjoe@boopasnoot:~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVotingWithRaft$ java -classpath ../../../../lib/sqlite-jdbc-3.15.1.jar:. deployment.ServerDeployer
DROP TABLE IF EXISTS RESULTS
hi
There are now 2 server(s)
There are now 2 server(s)
Published Server1117 on http://localhost:46924/RaftServer/Server1117
Service from rmi registry: jguddi
There are now 3 server(s)
Term: 0 Server1117: recieved the heart beat from Server1041
Server1117adding this data to staging area: Mary,Mary,Niamh,Holly,Holly,Holly,Holly,Jacinta,
Adding these votes to db: Mary,Mary,Niamh,Holly,Holly,Holly,Holly,Jacinta,
There are now 3 server(s)
Term: 0 Server1117: recieved the heart beat from Server1041
Server1117adding this data to staging area: Mary,Mary,Niamh,Holly,Holly,Holly,Holly,Jacinta,
Term: 0 Server1117: recieved the heart beat from Server1041
Server1117adding this data to staging area: Mary,Mary,Niamh,Holly,Holly,Holly,Holly,Jacinta,
There are now 3 server(s)
```

The Worst Case Scenario

Here we present the robustness of our distributed voting service. The situation presented is as follows.

1. Many votes have been cast.
2. The leader has crashed.
3. Another server has been brought online.
4. All servers bar the most recently started server have crashed.

It is evident in the client output that everything is fine from it's point of view. The only difference is that it is now requesting standings from a different server endpoint. This printout is only for the point of demonstration and a user of the client service would be ignorant to the change in leader endpoint.

Client

```
joe@boopasnoot: ~/IdeaProjects/DistributedVotingWithRaft/out/production/DistributedVoting
File Edit View Search Terminal Help
Enter a name to vote for from: Mary, Jacinta, Niamh, Holly
Mary
Client attempting to vote for: Mary
Voting to this endpoint: http://localhost:36240/RaftServer/Server6966?wsdl
vote cast for Mary
Enter a name to vote for from: Mary, Jacinta, Niamh, Holly
Holly
Client attempting to vote for: Holly
Voting to this endpoint: http://localhost:36240/RaftServer/Server6966?wsdl
vote cast for Holly
Enter a name to vote for from: Mary, Jacinta, Niamh, Holly
print
Client Requesting current votes
Voting to this endpoint: http://localhost:36240/RaftServer/Server6966?wsdl
Current Stats:
Mary: 3 votes
Jacinta: 0 votes
Niamh: 2 votes
Holly: 2 votes

Enter a name to vote for from: Mary, Jacinta, Niamh, Holly
print
Client Requesting current votes
Voting to this endpoint: http://localhost:40249/RaftServer/Server5046?wsdl
Current Stats:
Mary: 3 votes
Jacinta: 0 votes
Niamh: 2 votes
Holly: 2 votes
```