# Distributed Operating Systems Principles Project-1

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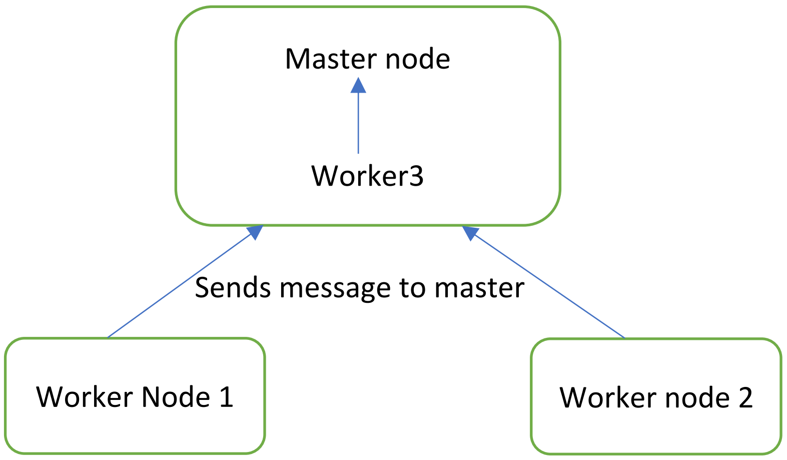
**Implementation:**

In my architecture, we have master and worker nodes. The worker mines the bitcoin and sends the message to master. Master listens to all the clients and collects the bitcoins and it itself mines the bitcoins. To obtain parallelism, we used actors in both master and server.

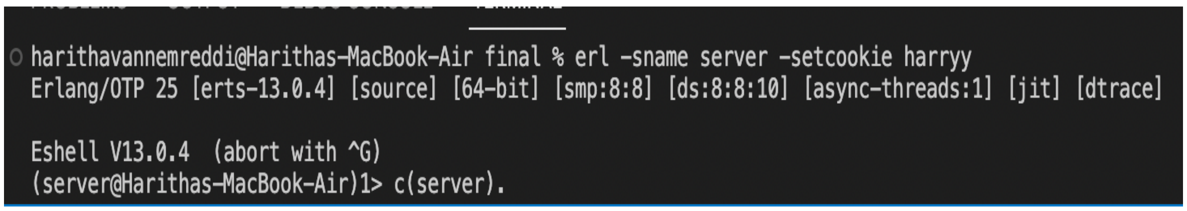


**Steps to execute the code**

1. Open two terminals in the same computer or use two machines.
2. In terminal 1, navigate to the directory where server code is present.
3. In terminal 2, navigate to the directory where client code is present.
4. In terminal 1, execute below command, so it opens erlang shell and sets the cookie

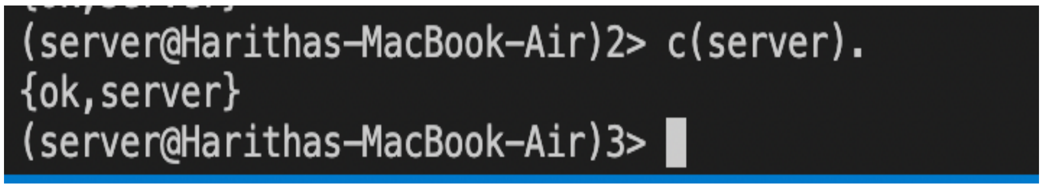
```
>> erl -name <name>@<ipaddress_of_current_system> -setcookie <cookie-name>
```

Example: erl -name server@ipaddress -setcookie hello



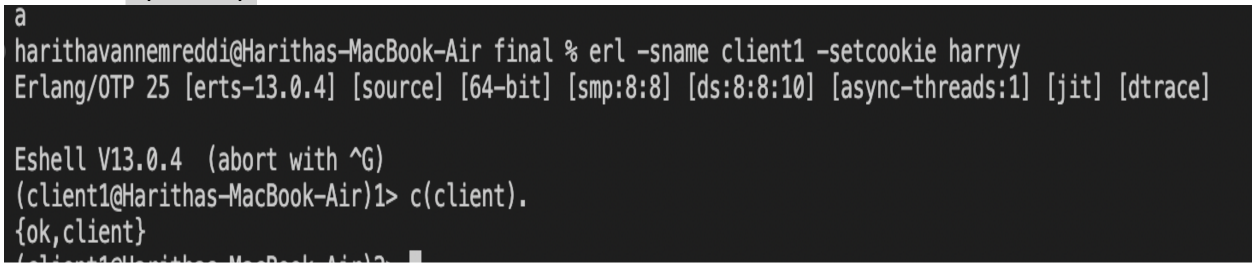
```
harithavannemreddi@Harithas-MacBook-Air final % erl -sname server -setcookie harryy
Erlang/OTP 25 [erts-13.0.4] [source] [64-bit] [smp:8:8] [ds:8:8:10] [async-threads:1] [jit] [dtrace]

Eshell V13.0.4  (abort with ^G)
(server@Harithas-MacBook-Air)1> c(server).
```

5. Now run the server module



```
(server@Harithas-MacBook-Air)2> c(server).
{ok,server}
(server@Harithas-MacBook-Air)3>
```

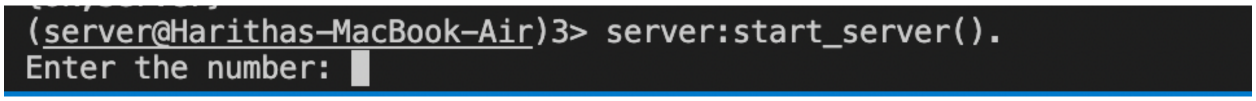
6. Navigate to terminal 2(client) and run the below command. This command opens the erlang shell and set the cookie.
   >>erl -name. client@ipaddress_current_system -setcookie hello
   >>c(client).



```
a
harithavannemreddi@Harithas-MacBook-Air final % erl -sname client1 -setcookie harryy
Erlang/OTP 25 [erts-13.0.4] [source] [64-bit] [smp:8:8] [ds:8:8:10] [async-threads:1] [jit] [dtrace]

Eshell V13.0.4  (abort with ^G)
(client1@Harithas-MacBook-Air)1> c(client).
{ok,client}
```

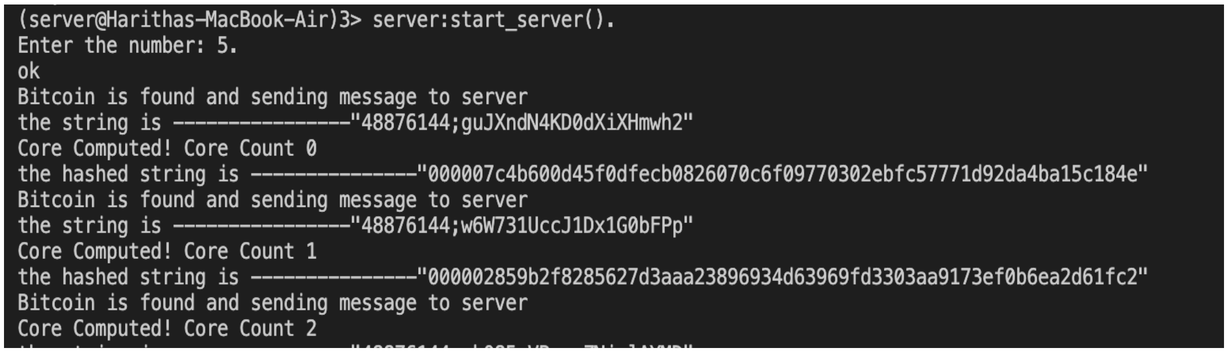
**Note:** Make sure cookies are same in client and server systems.

7)Navigate to terminal 1 and start the server by using below command.
   >>server:start_server().



```
(server@Harithas-MacBook-Air)3> server:start_server().
Enter the number:
```

8)Enter  the number of preceding zeros as input
   >>Enter the number:5.

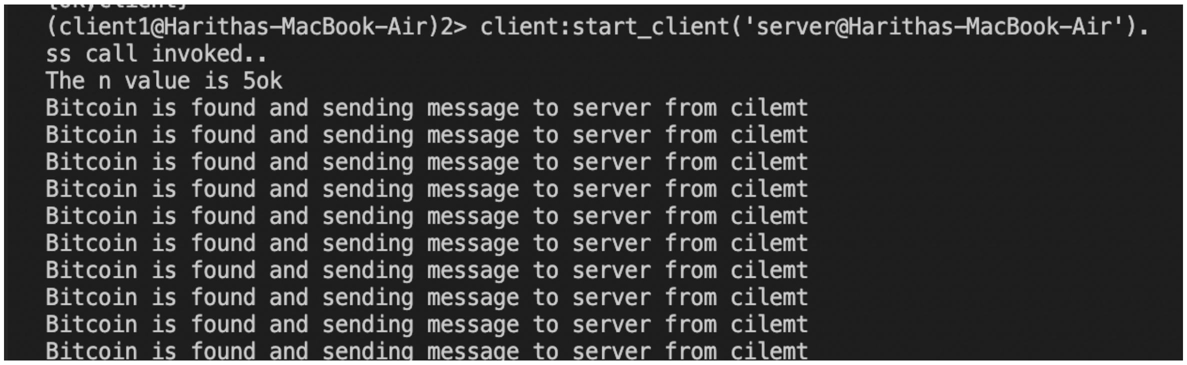


```
(server@Harithas-MacBook-Air)3> server:start_server().
Enter the number: 5.
ok
Bitcoin is found and sending message to server
the string is ---------------"48876144;guJXndN4KD0dXiXHmwh2"
Core Computed! Core Count 0
the hashed string is --------------"000007c4b600d45f0dfecb0826070c6f09770302ebfc57771d92da4ba15c184e"
Bitcoin is found and sending message to server
the string is ---------------"48876144;w6W731UccJ1Dx1G0bFPp"
Core Computed! Core Count 1
the hashed string is --------------"000002859b2f8285627d3aaa23896934d63969fd3303aa9173ef0b6ea2d61fc2"
Bitcoin is found and sending message to server
Core Computed! Core Count 2
```

**Note:** Don’t forget to give ‘.’ at the end.
Now server will start and start mining.

9. Now open terminal 2 and execute the below command to start client.

>>client:start_client(‘full name of terminal 2 or system2’).



```
(client1@Harithas-MacBook-Air)2> client:start_client('server@Harithas-MacBook-Air').
ss call invoked..
The n value is 5ok
Bitcoin is found and sending message to server from cilemt
Bitcoin is found and sending message to server from cilemt
Bitcoin is found and sending message to server from cilemt
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```
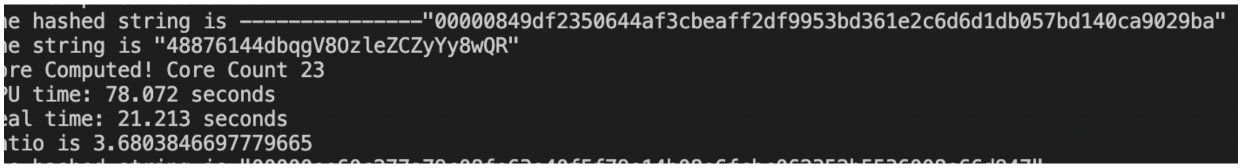

10)The CPU time/real time ratio is displayed as below



```
e hashed string is --------------"00000849df2350644af3cbeaff2df9953bd361e2c6d6d1db057bd140ca9029ba"
e string is "48876144dbqgV8OzleZCZyYy8wQR"
re Computed! Core Count 23
U time: 78.072 seconds
al time: 21.213 seconds
tio is 3.6803846697779665
```

**Results:**

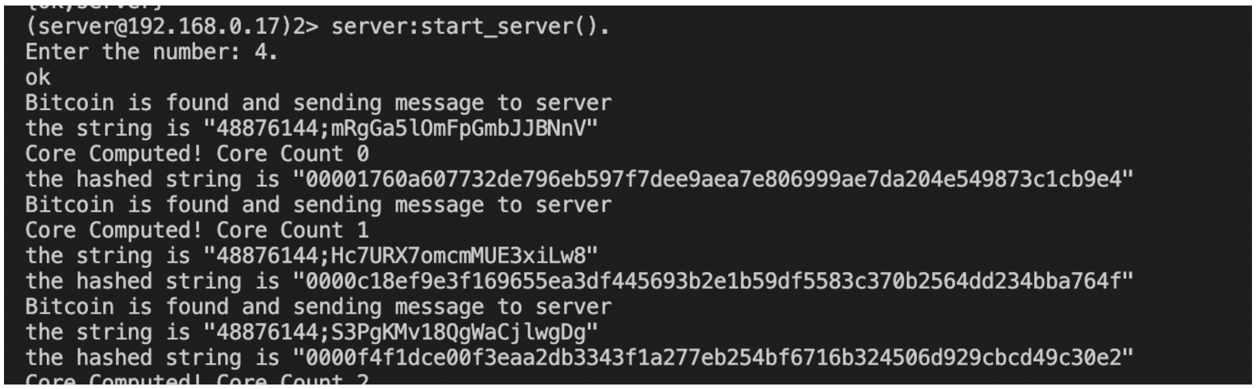
The implementation is done on two MacBook Air M2s with 8 CPUs (4 performance and 4 efficiency). Below are the results of the project.

1. The master node provides the input as a number of zeros to each worker. It generates a random string and a hash string, and if a bitcoin is found, it

sends messages to the master. The master also executes the search for bitcoins in our case. To achieve parallelism, we used actors' models. Each actor parallelly mines the bitcoin and sends the message to the master node. Once the bitcoin is found by a particular actor, the actor stops mining. To get the best performance, we created a number of actors based on the number of cores in the system CPU. Since we are using 8 core systems with 4 performance and 4 efficiency cores, we tried multiple values and found the best performance using the formula below.

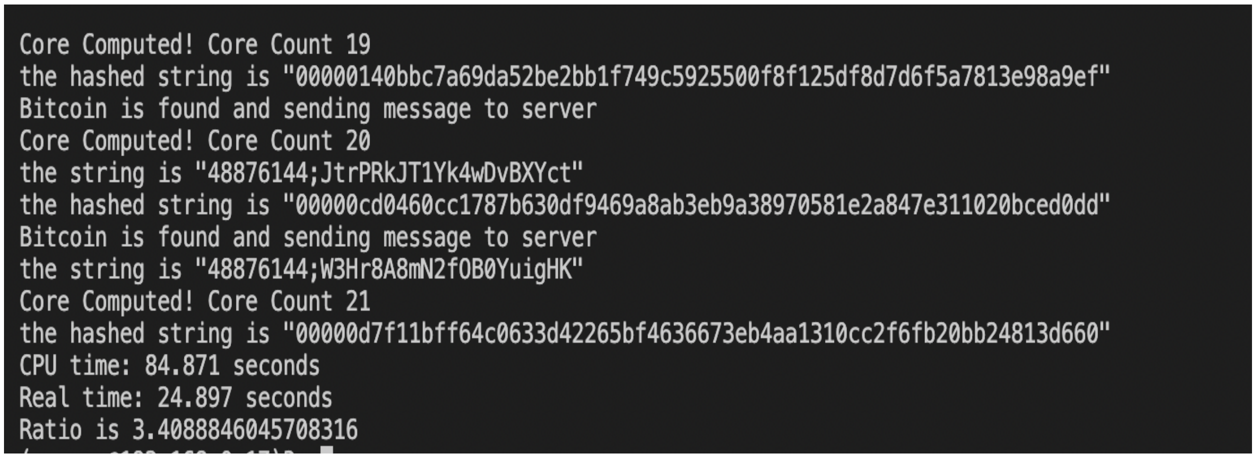
Number of actors= number of cores*2+6

2. The result when value of n=4



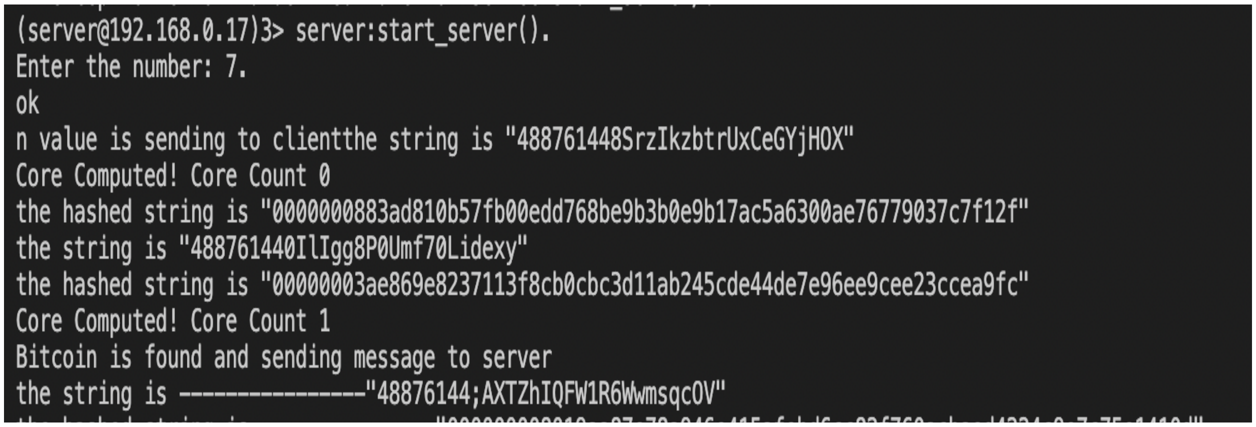
```
(server@192.168.0.17)2> server:start_server().
Enter the number: 4.
ok
Bitcoin is found and sending message to server
the string is "48876144;mRgGa5lOmFpGmbJJBNnV"
Core Computed! Core Count 0
the hashed string is "00001760a607732de796eb597f7dee9aea7e806999ae7da204e549873c1cb9e4"
Bitcoin is found and sending message to server
Core Computed! Core Count 1
the string is "48876144;Hc7URX7omcmMUE3xiLw8"
the hashed string is "0000c18ef9e3f169655ea3df445693b2e1b59df5583c370b2564dd234bba764f"
Bitcoin is found and sending message to server
the string is "48876144;S3PgKMv18QgWaCjlwgDg"
the hashed string is "0000f4f1dce00f3eaa2db3343f1a277eb254bf6716b324506d929cbcd49c30e2"
Core Computed! Core Count 2
```

3. The CPU time is 84.871 seconds and Real time is 24.89sec. The Ratio of CPU Ratio to Real time is 3.408 when N=4



```
Core Computed! Core Count 19
the hashed string is "00000140bbc7a69da52be2bb1f749c5925500f8f125df8d7d6f5a7813e98a9ef"
Bitcoin is found and sending message to server
Core Computed! Core Count 20
the string is "48876144;JtrPRkJT1Yk4wDvBXYct"
the hashed string is "00000cd0460cc1787b630df9469a8ab3eb9a38970581e2a847e311020bced0dd"
Bitcoin is found and sending message to server
the string is "48876144;W3Hr8A8mN2fOB0YuigHK"
Core Computed! Core Count 21
the hashed string is "00000d7f11bff64c0633d42265bf4636673eb4aa1310cc2f6fb20bb24813d660"
CPU time: 84.871 seconds
Real time: 24.897 seconds
Ratio is 3.4088846045708316
```

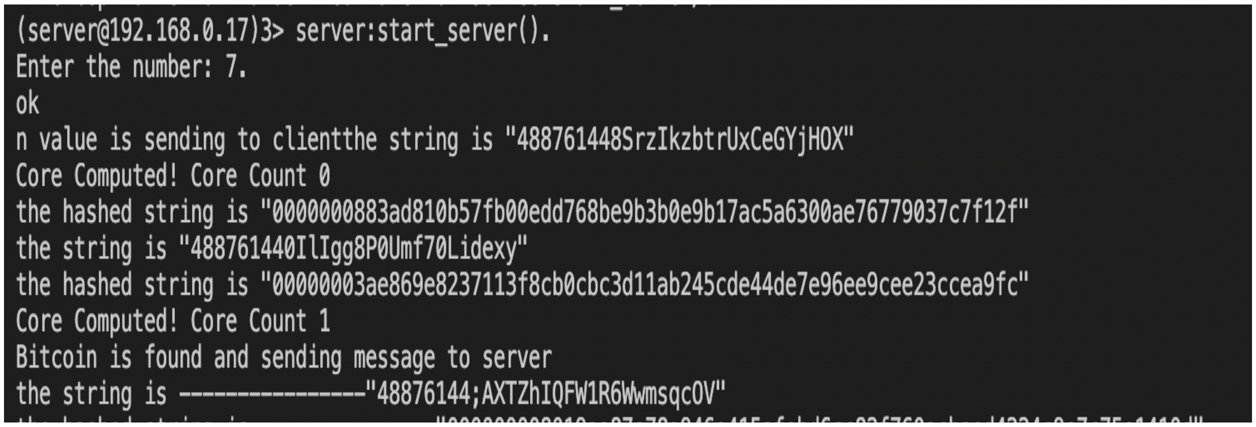
4. The coins with most 0’s we managed to get find when n=7.



```
(server@192.168.0.17)3> server:start_server().
Enter the number: 7.
ok
n value is sending to clientthe string is "488761448SrzIkzbtrUxCeGYjHOX"
Core Computed! Core Count 0
the hashed string is "0000000883ad810b57fb00edd768be9b3b0e9b17ac5a6300ae76779037c7f12f"
the string is "488761440IlIgg8P0Umf70Lidexy"
the hashed string is "00000003ae869e8237113f8cb0cbc3d11ab245cde44de7e96ee9cee23ccea9fc"
Core Computed! Core Count 1
Bitcoin is found and sending message to server
the string is ---------------"48876144;AXTZhIQFW1R6WwmsqcOV"
```

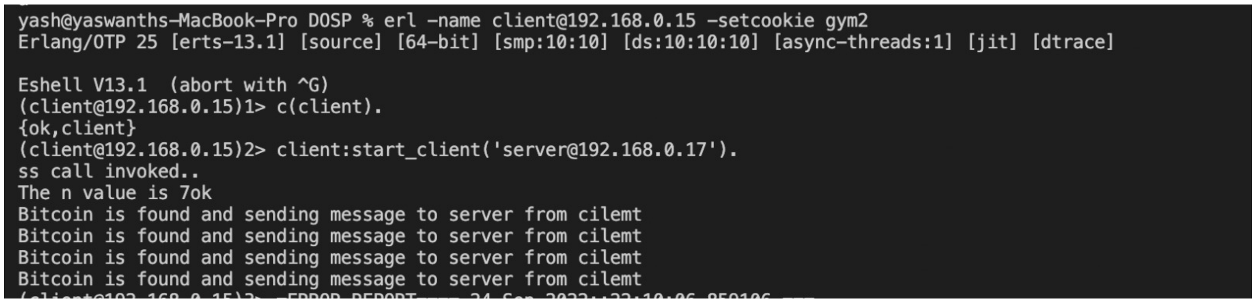
5. The largest number of working machines we can run is 2.

Machine1 as Master



```
(server@192.168.0.17)3> server:start_server().
Enter the number: 7.
ok
n value is sending to clientthe string is "488761448SrzIkzbtrUxCeGYjHOX"
Core Computed! Core Count 0
the hashed string is "0000000883ad810b57fb00edd768be9b3b0e9b17ac5a6300ae76779037c7f12f"
the string is "488761440IlIgg8P0Umf70Lidexy"
the hashed string is "00000003ae869e8237113f8cb0cbc3d11ab245cde44de7e96ee9cee23ccea9fc"
Core Computed! Core Count 1
Bitcoin is found and sending message to server
the string is ---------------"48876144;AXTZhIQFW1R6WwmsqcOV"
```

Machine2 as worker



```
yash@yaswanths-MacBook-Pro DOSP % erl -name client@192.168.0.15 -setcookie gym2
Erlang/OTP 25 [erts-13.1] [source] [64-bit] [smp:10:10] [ds:10:10:10] [async-threads:1] [jit] [dtrace]

Eshell V13.1  (abort with ^G)
(client@192.168.0.15)1> c(client).
{ok,client}
(client@192.168.0.15)2> client:start_client('server@192.168.0.17').
ss call invoked..
The n value is 7ok
Bitcoin is found and sending message to server from cilemt
Bitcoin is found and sending message to server from cilemt
Bitcoin is found and sending message to server from cilemt
Bitcoin is found and sending message to server from cilemt
```