COP5615 Distributed Operating System Principles

Project 4: Part 1-Twitter Engine and Simulation

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Project Description

In this project, we have come up with an implementation of a Twitter engine simulation. The engine is based on F# Akka Model and clients connected to the engine are distributed following the Zipf-distribution.

Overview:

The simulator engine can mock up a test simulation of how clients would interact with the engine in the real world. The functionalities implemented in the simulation include:

1. **Registering the user**
2. **Making a tweet using a word that is 100 characters long**
3. **Client retweeting a tweet of another user (represented by @mentions), and users following hashtags(represented by #hashtags)**
4. **Clients following or subscribing to other users (called Twitter mentions)**
5. **Querying tweets of clients who are logged-in, and logging off users randomly throughout the simulation session of 100s.**

Steps to run simulation:

To Run Engine: **dotnet fsi engine.fsx**

To Run Clients: **dotnet fsi clientSimulator.fsx <No. Of clients>**

Screenshots of running the simulation

```
➜ dosp-4-p1 dotnet fsi TwitterSimulation/engine.fsx
/var/folders/ht/pk_k0fs140d5ryw9xhlzgm4r0000gn/T/nuget/40839--fb0f7cae-cf10-45c4-aeef-177166c99fab/Project.fsproj : warning NU1605: Detected package downgrade: FSha
rp.Core from 6.0.1 to 5.0.0. Reference the package directly from the project to select a different version.
/var/folders/ht/pk_k0fs140d5ryw9xhlzgm4r0000gn/T/nuget/40839--fb0f7cae-cf10-45c4-aeef-177166c99fab/Project.fsproj : warning NU1605:  Project -> Akka.FSharp 1.4.28 -
> FSharp.Core (>= 6.0.1)
/var/folders/ht/pk_k0fs140d5ryw9xhlzgm4r0000gn/T/nuget/40839--fb0f7cae-cf10-45c4-aeef-177166c99fab/Project.fsproj : warning NU1605:  Project -> FSharp.Core (>= 5.0.
0)
/var/folders/ht/pk_k0fs140d5ryw9xhlzgm4r0000gn/T/nuget/40839--fb0f7cae-cf10-45c4-aeef-177166c99fab/Project.fsproj : warning NU1605: Detected package downgrade: FSha
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/var/folders/ht/pk_k0fs140d5ryw9xhlzgm4r0000gn/T/nuget/40839--fb0f7cae-cf10-45c4-aeef-177166c99fab/Project.fsproj : warning NU1605:  Project -> Akka.FSharp 1.4.28 -
> FSharp.Core (>= 6.0.1)
/var/folders/ht/pk_k0fs140d5ryw9xhlzgm4r0000gn/T/nuget/40839--fb0f7cae-cf10-45c4-aeef-177166c99fab/Project.fsproj : warning NU1605:  Project -> FSharp.Core (>= 5.0.
0)
[INFO][01/12/2021 07:49:30][Thread 0001][remoting (akka://RemoteFSharp)] Starting remoting
[INFO][01/12/2021 07:49:30][Thread 0001][remoting (akka://RemoteFSharp)] Remoting started; listening on addresses : [akka.tcp://RemoteFSharp@localhost:9001]
[INFO][01/12/2021 07:49:30][Thread 0001][remoting (akka://RemoteFSharp)] Remoting now listens on addresses: [akka.tcp://RemoteFSharp@localhost:9001]
Total requests processes: 51769
Total tweets sent: 52412
```

Figure1: Running the Twitter Engine after the simulation terminates prints out the Total requests processes and Total number of tweets sent

```
➜ dosp-4-p1 dotnet fsi TwitterSimulation/clientSimulator.fsx 10
/var/folders/ht/pk_k0fs140d5ryw9xhlzgm4r0000gn/T/nuget/43209--add97809-15fc-4398-aa63-245d72372bd1/Project.fsproj : warning NU1605: Detected package downgrade: FSha
rp.Core from 6.0.1 to 5.0.0. Reference the package directly from the project to select a different version.
/var/folders/ht/pk_k0fs140d5ryw9xhlzgm4r0000gn/T/nuget/43209--add97809-15fc-4398-aa63-245d72372bd1/Project.fsproj : warning NU1605:  Project -> Akka.FSharp 1.4.28 -
> FSharp.Core (>= 6.0.1)
/var/folders/ht/pk_k0fs140d5ryw9xhlzgm4r0000gn/T/nuget/43209--add97809-15fc-4398-aa63-245d72372bd1/Project.fsproj : warning NU1605:  Project -> FSharp.Core (>= 5.0.
0)
/var/folders/ht/pk_k0fs140d5ryw9xhlzgm4r0000gn/T/nuget/43209--add97809-15fc-4398-aa63-245d72372bd1/Project.fsproj : warning NU1605: Detected package downgrade: FSha
rp.Core from 6.0.1 to 5.0.0. Reference the package directly from the project to select a different version.
/var/folders/ht/pk_k0fs140d5ryw9xhlzgm4r0000gn/T/nuget/43209--add97809-15fc-4398-aa63-245d72372bd1/Project.fsproj : warning NU1605:  Project -> Akka.FSharp 1.4.28 -
> FSharp.Core (>= 6.0.1)
/var/folders/ht/pk_k0fs140d5ryw9xhlzgm4r0000gn/T/nuget/43209--add97809-15fc-4398-aa63-245d72372bd1/Project.fsproj : warning NU1605:  Project -> FSharp.Core (>= 5.0.
0)
[INFO][01/12/2021 19:44:49][Thread 0001][remoting (akka://RemoteFSharp)] Starting remoting
[INFO][01/12/2021 19:44:49][Thread 0001][remoting (akka://RemoteFSharp)] Remoting started; listening on addresses : [akka.tcp://RemoteFSharp@localhost:60143]
[INFO][01/12/2021 19:44:49][Thread 0001][remoting (akka://RemoteFSharp)] Remoting now listens on addresses: [akka.tcp://RemoteFSharp@localhost:60143]
10 clients registered
username5 is subscribed by username3 is subscribed by username2 is subscribed by username1 is subscribed by ["username3"]
username1 is subscribed by ["username4"]
username2 is subscribed by ["username5"]
["username4"; "username5"]
["username3"; "username4"]
username1 is subscribed by ["username3"; "username4"; "username5"]
["username7"]
username4 is subscribed by ["username6"]
username6 is subscribed by username8 is not subscribed by anyone.
username7 is not subscribed by anyone.
```

```
Tweet received by "username4" tweet: "Mention: v4eOo4AzDgrFfY47aArGDMdGYb4zlrgWVmCCruWibKqvyM0fIJW58SXBIqI @username7 username2" from "username2"
Tweet received by Tweet received by Tweet received by "username5""username7" tweet: "username8" tweet:  tweet: "Mention: 7pE#nuHi7JVLSZkNHIEaTalJSacex6HP6QPDYQoireE
sst1dyhNfy51OWNa5#lCTUYxV3zHJceCwoM9g2Ry9bj# @username9 username3" from "username3"
"RETWEET: Mention: h8L9Gqx#Cj7ou17muC80jtoZjZytz12puZSnJL4Y2vUNMPZwjTH3l5e @username1 username4username6" from "RETWEET: Mention: Gx09b92tT#e0JQ @username7 username
2username5" from "username6"
"username5"
Tweet received by "username6" tweet: "Mention: L#7b58OfALLWj2NJLCbCNuA5npsfS9z3FYMJxgjx742vtDJL0qJAU#c9sVHyxrfj4A9e9W4mawnBkXtByz8khS1nDv9vrESx @username1 username4
" from "username4"
Tweet received by "username4" tweet: Tweet received by "username5" tweet: "Mention: ST64TnDLdjyzw1nMdA144GJvn4GVhTMTEJiawev328Uh3eqZm4f1hwU52syHzAldpxNFB58SXQVOEkk1
vAq7vDt0I62Wy @username7 username2" from "Mention: ST64TnDLdjyzw1nMdA144GJvn4GVhTMTEJiawev328Uh3eqZm4f1hwU52syHzAldpxNFB58SXQVOEkk1vAq7vDt0I62Wy @username7 username
2" from "username2"
Tweet received by "username4" tweet: "username2"
"Mention: ST64TnDLdjyzw1nMdA144GJvn4GVhTMTEJiawev328Uh3eqZm4f1hwU52syHzAldpxNFB58SXQVOEkk1vAq7vDt0I62Wy @username7 username2" from "username2"
```

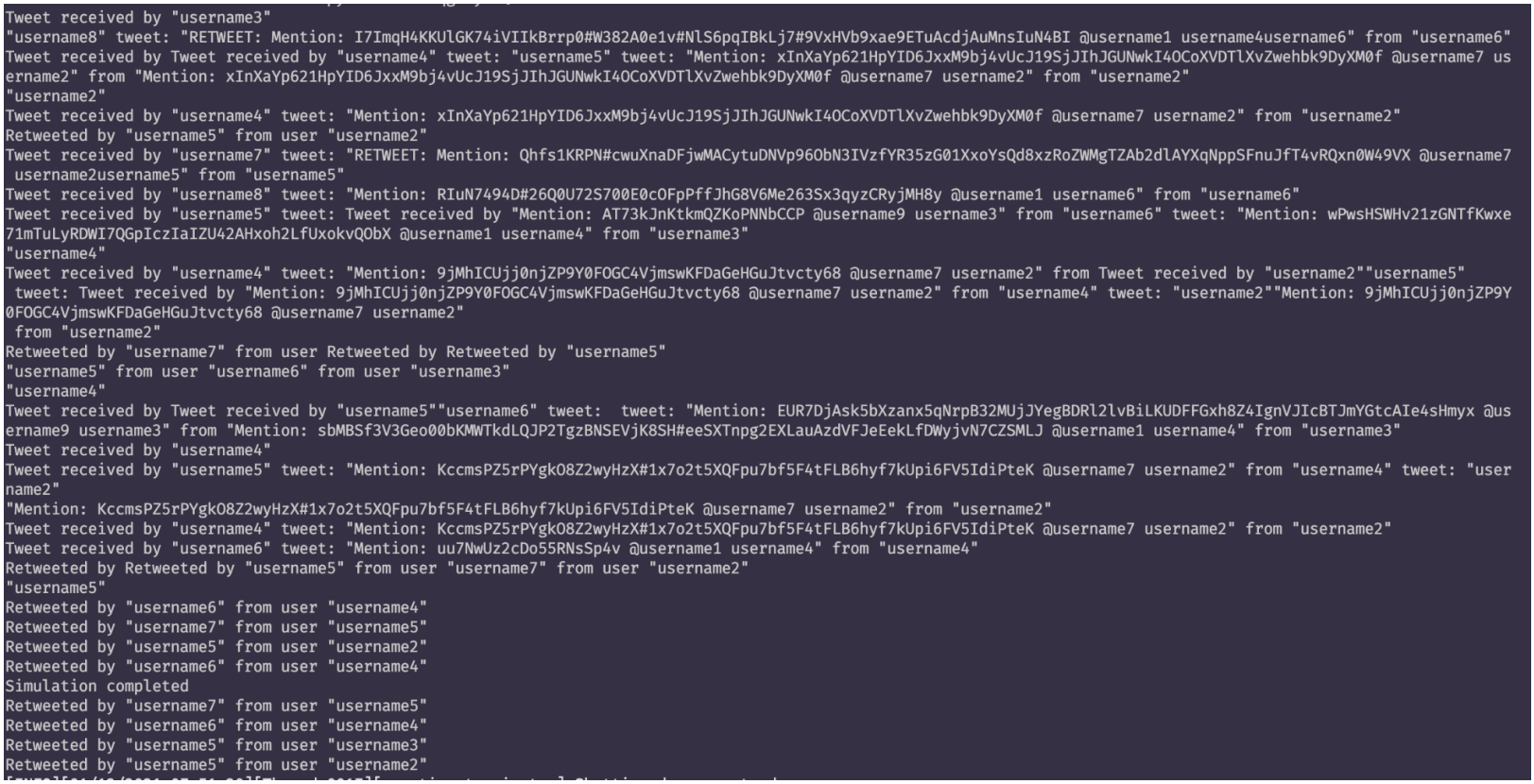

Figure 2: Running the Twitter Client Simulates the engine

Results

For the purpose of simulating the engine we have performed the aforementioned operations in randomlyn for a **set duration of 100 seconds** after which the simulation comes to an halt. **The maximum number of clients that are engine caters to is 10,000**. In order to measure the performance of our system we tried to find the relationship between the total number of tweets posted vs the total number of queries processes by our engine. We found that as the number of clients are increased after each iteration of testing, the number of tweets processed by our system also increases proportionally.Taking this as a baseline, we came up with the following observations for each of our iterations enlisted below:

No. of Users	No. of Queries Processed	Total no. of Tweets
10	51106	52765
1000	732471	89478
10,000	115243	203786

Plot of No. of Users V/S No. of subscribers

It is evident from **the graph that the distribution followed for- No. of users vs No. of subscribers(followers) is zip-f**. For the **initial users ~300, we tend to have high number of subscribers**, however this takes a hit in later iterations as we increase the number of users as this process becomes computationally heavvy and number of subscribers drop significantly.

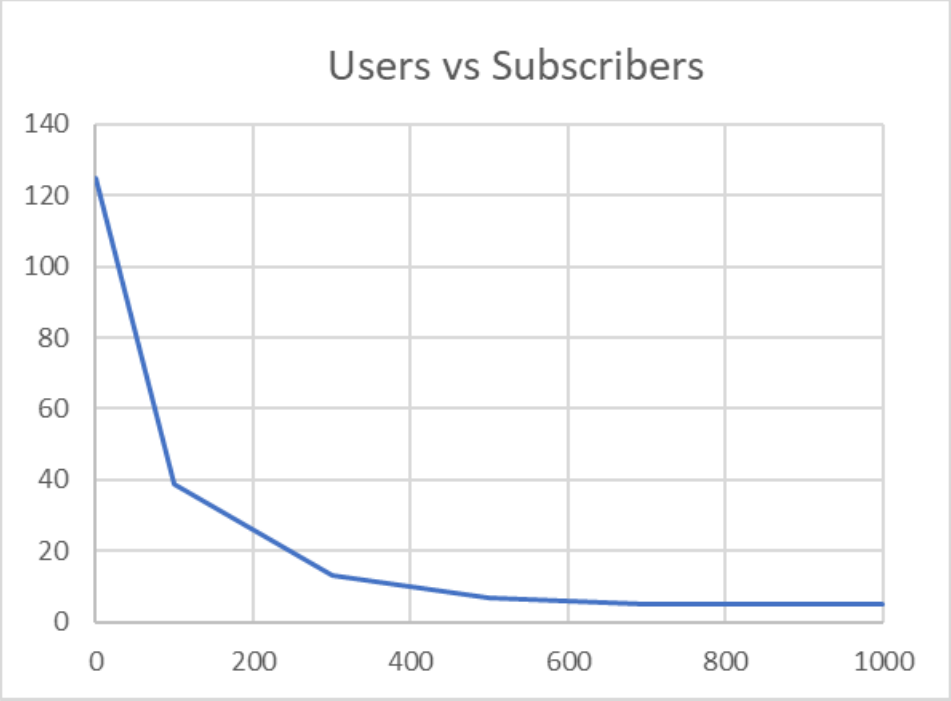

Figure 3: Zipf distribution graph