

Distributed Operating Systems Principles and Paradigms Project 4

Report

Team Members-

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The following are the Actors used in the code-

- **UserGenerator**-The task of the UserGenerator is to create clients. It creates as many clients as provided and then these clients become the users of Twitter Clone.
- **User**-An independent twitter user, which is an actor which is created by the **UserGenerator**.
- **TwitterEngine**- It's task is to gather & store tweets, retweets, search and return tweet results being the server of the Twitter Clone. It is also used to fanout tweets and retweets back to the client homepage. **Note**- The term fanout actually means the distribution of tweets and retweets. This takes place between the client and its live followers.
- **Simulator**-The main responsibility of the simulator is to perform many and different types of tests on the Twitter Clone in order to calculate its performance. It also deives the twitter clone

Working process of simulator, server and engine fanout-

- The input is taken from the console regarding how many users are required to be created. This input is initially taken by the simulator which then asks the UserGenerator to perform the task of creating the inputted amount of users respectively. Our condition for minimum users is 500.
- **Zipf distribution**- the clients are created first and after the completion of this task the followers are assigned to each user by the simulator using zipf distribution. The work of the zipf distribution is to simply mention how many followers a client should have.
- Tweet, retweet and search functionality- Mainly driven by simulator and executed by User, Twitter Engine

- **Tweet-** Tweet can be initiated by one or multiple clients just that a simulator needs to instantiate the user first. There is a tweet database from where the user searches for a random tweet and then tweets it. A tweet consists of the following-

1. Text
2. Hashtag
3. UserTagged

- While searching for the tweet from the tweet database the user side by side also sends the tweet to the Twitter Engine and the Twitter Engine then stores the tweets in a tweet map.

Note- Tweet map is a storage for all the tweets from the user.

- When none of the followers of the user are live or connected- the twitter engine stores the tweets in a map called pending tweet. The map has the userID as key and the tweet.

- When some followers are live the tweet gets displayed on the home page of the user and the distribution of the tweet is done by Twitter Engine.

- When some or all the followers go live the follower requests the Twitter Engine to show all the pending tweets. The tweets are taken from the pending tweets map and then displayed on the follower's timeline.

- **Retweet-** Similar to a tweet- simulator triggers the users for retweets and then the user retweets a tweet. This tweet is taken from the home page of the users. Lastly, the process of distributing the tweet and displaying it on the home page is the same as done for a tweet.

- **Search-** Similar to tweet and retweet simulator triggers the user for searching the tweets

Steps to run the code-

- To run the code the first step is to unzip the file
- Then we open the fsx project
- Then run the code for any number of users greater than 500 the command for the same is-

dotnet fsi --langversion:preview project4.fsx #Users

Test cases-

The user inputs the number of clients that need to be built. The maximum number of users for which our twitter clone works is 50000.

- In this project we have implemented a twitter engine in which every user tweets a total of 10 tweets and then the twitter engine distributes it to the user's followers. This means that the tweet will reach multiple followers. In the following output we have shown the amount of time in milliseconds it takes for a tweet to reach multiple followers in the twitter clone.

```
Twitter clone of 10000 Users Initiated:
24698519
24698520
Time taken to for circulating 24698520 tweets : 198307.318100
-----
```

```
-----
C:\Users\ec1ai\AppData\Local\Temp\nuget\24776--593d29bb-db77-4b25-89fc-c2c090df357c\Project.fsproj :
-> FSharp.Core (>= 6.0.1)
C:\Users\ec1ai\AppData\Local\Temp\nuget\24776--593d29bb-db77-4b25-89fc-c2c090df357c\Project.fsproj :
.0)
Twitter clone of 50000 Users Initiated:
█
```

- In the twitter engine each user retweets 1 tweet that the twitter engine distributes to multiple user's followers. Therefore, if a user has 10000 followers then the total number of tweets would be 10000 given that every user retweets only once. In the following output we show the amount of time taken in milliseconds for the retweet to reach multiple users.

```
-----
Time taken to for circulating 2486588 retweets : 13347.089400
-----
```

- In this output we have chosen a random user that is **User9896** and listed out all the followers of the user

```
-----
Followers of User9896 :
42 47 72 150 167 173 198 207 247 268 312 320 323 414 422 557 581 637 673 695 721 779 872 940 944 1102 1120 1157 1165 1199 1205 1277 1331 1370 1442 1450 1459 1785 1811 1844 1975 2041 20
91 2098 2156 2165 2179 2277 2310 2338 2419 2444 2555 2706 2760 2823 2825 2850 2873 3020 3043 3080 3138 3184 3198 3208 3247 3256 3285 3310 3322 3400 3446 3493 3533 3569 3680 3706 3716 3
723 3740 3852 3870 3998 4013 4026 4033 4071 4093 4098 4100 4102 4223 4364 4407 4468 4490 4553 4768 4800 4887 4922 4955 5004 5009 5040 5057 5117 5126 5184 5373 5468 5474 5579 5609 5614
5687 5711 5730 5783 5806 5810 5836 5881 5904 5906 5929 5979 6106 6109 6152 6199 6223 6236 6273 6301 6327 6331 6442 6459 6572 6611 6622 6646 6806 6814 6875 6927 6930 6945 6975 7003 7077
7095 7244 7349 7356 7447 7470 7489 7490 7568 7629 7639 7689 7737 7779 7873 7889 7942 8008 8047 8059 8064 8076 8080 8144 8196 8200 8235 8276 8299 8418 8560 8582 8605 8831 8833 8920 896
7 9016 9052 9140 9152 9244 9364 9373 9451 9570 9619 9645 9721 9724 9825 9876 9878 9881 9890 9901 9924 9992
Random follower Selected is 6875
-----
```

- In this output we choose a random follower from the above list that is **User6875** and list out all the users following **User6875**

```
Following of User6875 :
Following List.
18 25 85 89 103 143 145 214 241 303 310 327 350 352 472 483 491 590 696 706 834 840 868 903 916 939 961 1001 1093 1138 1159 1192 1224 1240 1243 1324 1404 1478 1601 1676 1737 1743 1759
1757 1810 1846 1897 1926 1928 1934 2045 2112 2144 2173 2210 2235 2255 2262 2264 2274 2327 2413 2431 2451 2459 2504 2520 2644 2669 2729 2750 2779 2868 2871 2940 2993 3010 3081 3084 3117
3136 3167 3171 3212 3228 3243 3381 3435 3479 3495 3497 3613 3621 3630 3705 3709 3730 3772 3782 3823 3870 3882 3974 4090 4172 4211 4227 4241 4282 4340 4403 4441 4463 4465 4549 4579 463
4 4698 4712 4787 4844 4869 4920 4932 4968 4987 4989 5039 5049 5066 5072 5090 5118 5136 5149 5248 5326 5382 5462 5464 5562 5647 5725 5732 5817 5841 5915 5963 5991 6040 6150 6167 6170 62
53 6454 6488 6528 6549 6557 6562 6581 6632 6640 6658 6690 6725 6727 6732 6741 6768 6789 6806 6819 6826 6869 6913 6946 6989 7007 7100 7122 7167 7187 7254 7392 7393 7414 7463 7471 7572 7
589 7727 7744 7774 7787 7807 7813 7880 7898 7938 7957 8013 8106 8159 8169 8188 8263 8272 8283 8292 8310 8349 8350 8457 8507 8512 8558 8574 8635 8721 8731 8774 8791 8859 8878 8882 9058
9070 9144 9210 9211 9232 9243 9252 9256 9284 9288 9306 9321 9383 9554 9572 9585 9618 9635 9658 9659 9671 9682 9709 9717 9759 9790 9804 9830 9834 9896 9911 9920 9938 9998
```

- In this output we select a user for eg- **User6875** and make it offline and then select another user that is **User9896** that sends a tweet and we are able to show that **User6875's** timeline doesn't get updated as the user is offline. We then display the homepage of the **User6875** showing past 6 tweets of the user but the most recent tweet of **User9896** is not visible.

```
-----
User 6875 goes Offline
```

```
User 9896 makes a tweet, user6875's Timeline doesn't get updated as the user is offline
```

```
User6875's HomePage when it is offline
```

```
User6875's HomePage when it is offline
```

```
Tweet id: User29748
Tweet message: #tweet3 @User3 @KHIGH Likes BTS, Bangtan Sonyeondan #BTSArmy #HYBE
Tweet Created By: 9756
Retweet by: User9998
```

```
Tweet id: User42905
Tweet message: #tweet5 @User5 @KHIGH Likes BTS, Bangtan Sonyeondan #BTSArmy #HYBE
Tweet Created By: 2917
Retweet by: User9938
```

```
Tweet id: User69693
Tweet message: #tweet7 @User7 @KHIGH Likes BTS, Bangtan Sonyeondan #BTSArmy #HYBE
Tweet Created By: 9693
Retweet by: User9920
```

```
Tweet id: User43436
Tweet message: #tweet5 @User5 @KHIGH Likes BTS, Bangtan Sonyeondan #BTSArmy #HYBE
Tweet Created By: 3448
Retweet by: User9911
```

```
Tweet id: User97149
Tweet message: #tweet10 @User10 @KHIGH Likes BTS, Bangtan Sonyeondan #BTSArmy #HYBE
Tweet Created By: 7150
Retweet by: User9896
```

```
Tweet id: User38734
Tweet message: #tweet4 @User4 @KHIGH Likes BTS, Bangtan Sonyeondan #BTSArmy #HYBE
Tweet Created By: 8732
Retweet by: User9834
```

```
-----
```

- The user in the above output, **User6875** then comes online and now the user should be able to see the tweet from **User9896**.

```
-----
User 6875 comes Online
User6875's HomePage when it is online

Tweet id: User100001
Tweet message: DJ Turn it up #YellowClaw @User6875 YOu Can't see me
Tweet Created By: 9896

Tweet id: User29748
Tweet message: #tweet3 @User3 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet Created By: 9756
Retweet by: User9998
```

```
Tweet id: User42905
Tweet message: #tweet5 @User5 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet Created By: 2917
Retweet by: User9938

Tweet id: User69693
Tweet message: #tweet7 @User7 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet Created By: 9693
Retweet by: User9920
```

```
Tweet id: User43436
Tweet message: #tweet5 @User5 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet Created By: 3448
Retweet by: User9911

Tweet id: User97149
Tweet message: #tweet10 @User10 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet Created By: 7150
Retweet by: User9896
-----
```

- Lastly, we run the search functionality for a total of 10000 nodes.
The keyword inputted is Bangtan and the time taken to search is 0.612300
The searching time for usertagged: @User2 is 0.226500
The searching time for hashtag: #BTSArmy in system is: 0.212100

```
Tweet id: User6
Tweet message: #tweet1 @User1 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet userid: 7

Tweet id: User7
Tweet message: #tweet1 @User1 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet userid: 8

Tweet id: User8
Tweet message: #tweet1 @User1 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet userid: 9

-----
Searching for hashtag: #BTSArmy
Time taken(in ms) to search #BTSArmy in system is: 0.263400
-----
Total Search results found: 50000
Top 8 results are:

Tweet id: User1
Tweet message: #tweet1 @User1 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet userid: 1
```

```
-----
Total Search results found: 100000
Top 8 results are:

Tweet id: User1
Tweet message: #tweet1 @User1 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet userid: 1

Tweet id: User2
Tweet message: #tweet1 @User1 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet userid: 6

Tweet id: User3
```

```
Tweet id: User3
Tweet message: #tweet1 @User1 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet userid: 10

Tweet id: User4
Tweet message: #tweet1 @User1 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet userid: 12

Tweet id: User5
Tweet message: #tweet1 @User1 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet userid: 13
```

```
Tweet id: User7
Tweet message: #tweet1 @User1 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet userid: 15

Tweet id: User8
Tweet message: #tweet1 @User1 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet userid: 16

Total Search results found: 0
Top 8 results are:

Total Search results found: 100000
```

Tweet id: User69693
Tweet message: #tweet7 @User7 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet Created By: 9693
Retweet by: User9920

Tweet id: User43436
Tweet message: #tweet5 @User5 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet Created By: 3448
Retweet by: User9911

Tweet id: User97149
Tweet message: #tweet10 @User10 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet Created By: 7150
Retweet by: User9896

Tweet id: User38734
Tweet message: #tweet4 @User4 @KHIGH Likes BTS, Bangtan Sonyneondan #BTSArmy #HYBE
Tweet Created By: 8732
Retweet by: User9834

Results-

| Number of Nodes | Time taken(milliseconds) |
|-----------------|--------------------------|
| 5000 | 0.409200 |
| 20000 | 0.782400 |
| 50000 | 1.54500 |