

Task 6

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1 Goal

Define the capacity of BlogEngine.NET 3.2. for cases below and compare results:

- Perform Capacity testing for the same probabilities for all branches (Task 3) with two sets of generated posts (100 and 1000)
- Perform Capacity testing for the different percentage probability for all branches (Task 6) with two sets of generated posts (100 and 1000)

Prerequisites: previously generated 100 and 1000 posts.

Testing scenario: simulating user behavior on the site, where he visits different pages, opens posts and leave comments.

Test environment: test application and load generator are running on the same computer. Application is executed on the virtual machine and the load generator is executed on the host.

2 Summary

The most pronounced change in the load model affected Capacity for "Task 3" and "Task 6" for 100 posts. For cases "Task 3" and "Task 6" for 1000 posts, the change in the load model was not so pronounced.

3 What was tested

BlogEngine.NET 3.2 (web) (Executed on the application server)

Parameters of the system under test:

VirtualBox Graphical User Interface Version 7.0.4 r154605 (Qt5.15.2), Windows Server 2016 Standard (64-bit)

OS Name: Microsoft Windows 10 Enterprise, (64-bit) Version 10.0.19044 Build 19044

Base memory: 2,0Gb

Processor: Intel(R) Core(TM) i7-10610U CPU @ 1.80GHz, 2304 Mhz, 1 Core(s), 1 Logical Processor(s)

Storage: Virtual size 60.00 GB

Network: Bridged adapter, Intel® Wi-Fi 6 AX201 160Mhz

4 Load generator system options

Load generator tool: Apache JMeter 5.5 (Executed on Host)

OS Name: Microsoft Windows 10 Enterprise (64-bit) Version 10.0.19045 Build 19045

Base memory: 32,0 GB

Processor: Intel(R) Core(TM) i7-10610U CPU @ 1.80GHz, 2304 Mhz, 4 Core(s), 8 Logical Processor(s)

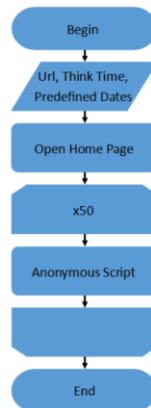
Storage: C: 248 Gb, D: Locked

Running Tests: Jenkins

Collection and visualization of metrics: InfluxDB, Telegraf, Grafana

5. Main script

First, open the home page then 50 times runs Anonymous Script.



6 Anonymous script

For the case named "Task 3":

Step 1. Open randomly one of these pages: home page, page of random date, page of predefined date from csv file, page with search result, large calendar page, and a contacts page.

Step 2. If Step 1 is opened one of the first three pages (home page, page of random date, page of predefined date from csv file) then make a random decision to open or not to open a random page (if there is more than one page with posts).

Step 3. After Step 2 (or after Step 1 if there was no opened one of the first three pages) make a random decision to open or not to open a post.

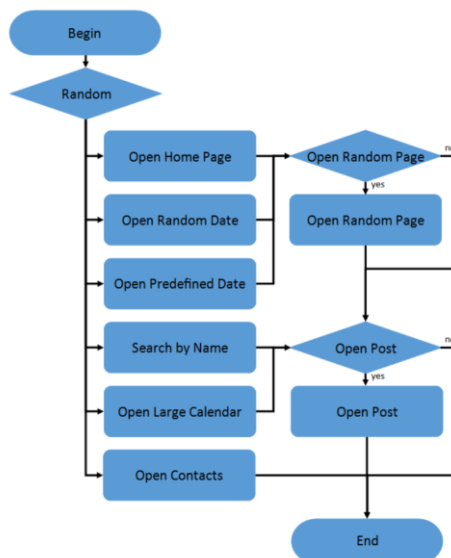
For the case named "Task 6" the behavior is similar except for the transition probabilities which are set as follows:

1. Home Page: 15%
2. Open Random Date: 10%
3. Open Predefined Date: 30%
4. Search by Name: 30%
5. Open Large Calendar: 10%
6. Open Contacts: 5%

Open Random page (yes/no): 50% / 50%

Open post (yes/no): 80% / 20%

Random or First post: 65% / 35%



7 Open post script

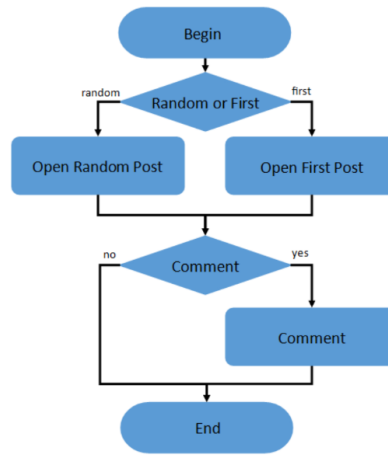
For the case named "Task 3":

Step 1. Make a random decision to open a random post of the first post

Step 2. Make a random decision to add a comment or not.

For the case named "Task 6" the behavior is similar except for the transition probabilities which are set as follows:

Comment (yes/no): 20% / 80%



8 Test results

8.1. Comparing "Task 3" and "Task 6" results for 100 posts

100 users, ramp-up 200 seconds, duration 300 seconds

	"Task 3" 100 posts	Task 6 100 posts
Capacity (users)	85	53
Throughput (successful transactions per second)	119	81.8
Capacity point (time)	09:24:00	10:43:45

In cases "Task 3" and "Task 6" for 100 posts, the load model has changed significantly.

The load on the system increased as the probability of switching to the Contacts page decreased from 16.7% to 5% after the algorithm provided for the completion of the iteration without switching to other pages.

The increase in load was also affected by a decrease from 16.7% to 10% in the probability of going to the Open Random Date and Open Large Calendar pages, where there was a minimum probability of encountering posts.

The increase from 16.7% to 30% of the probability of going to the pages "Open Predefined Date" and "Search by Name" provided an increase in the number of clicks to pages with 100% probability of having posts. In addition to this, the increase from 50% to 80% of the probability of "Open post" increased from 18% to 33% of the total number of transactions the execution of such actions (in total "TC_Open first post" and "TC_Open Random post"), namely the same type of competitive requests. Although the probability of "Comment - yes" decreased from 50% to 20% (2.5 times), but due to the fact that the number of posts as described above increased significantly, this led to the fact that "Comment - yes" actually decreased only from 9% to 6 % of total transactions.

The change in load described above led to a shift in the Capacity point of the system and significantly increased the average response time.

Aggregate report Task 3 for 100 posts:

transaction ->	NumberOfSamples	Average	pct90	pct95	pct99	Min	Max	Error Count
TC_Open Contacts	6.03 K	1.07 K	2.84 K	3.34 K	4.47 K	0.00	4.47 K	-
TC_Open Home page	5.95 K	1.08 K	2.92 K	3.32 K	4.42 K	0.00	4.42 K	-
TC_Open Large Calendar	5.97 K	1.08 K	2.86 K	3.36 K	4.48 K	0.00	4.48 K	-
TC_Open Predefined Date	5.95 K	1.07 K	2.86 K	3.28 K	4.42 K	0.00	4.42 K	-
TC_Open Random Date	5.86 K	1.08 K	2.89 K	3.33 K	4.46 K	0.00	4.50 K	-
TC_Open Random page >1	284.00	765.20	2.52 K	2.99 K	4.23 K	5.00	4.23 K	-
TC_Open Random page >1	2.67 K	1.06 K	2.93 K	3.67 K	4.41 K	4.00	4.41 K	-
TC_Open Random post	4.78 K	1.09 K	2.94 K	3.55 K	4.47 K	4.00	4.47 K	-
TC_Open first post	4.66 K	1.17 K	3.02 K	4.07 K	6.82 K	0.00	6.87 K	-
TC_Search by Name	5.96 K	1.08 K	2.90 K	3.33 K	4.42 K	0.00	4.42 K	-
TC_leave a comment	4.68 K	1.21 K	2.94 K	3.75 K	79.06 K	0.00	79.17 K	2.00
TC_start_Open Home page	814.00	970.86	2.68 K	3.17 K	4.37 K	5.00	4.37 K	-

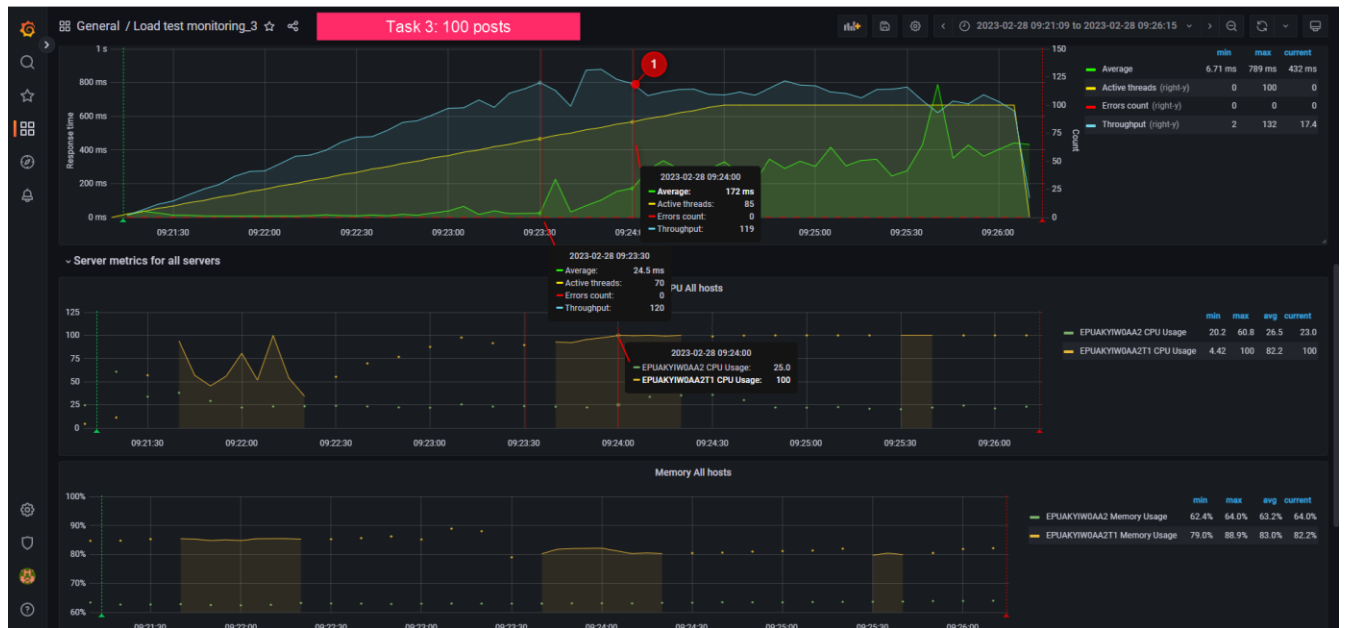
Aggregate report Task 6 for 100 posts:

transaction ->	NumberOfSamples	Average	pct90	pct95	pct99	Min	Max
Open Random post	7.49 K	2.05 K	4.71 K	5.07 K	7.30 K	5.00	7.30 K
Open first post	4.00 K	2.07 K	5.06 K	5.49 K	7.34 K	5.00	7.34 K
TC_Open Contacts	791.00	1.84 K	4.90 K	5.08 K	6.61 K	4.00	6.61 K
TC_Open Home page	2.86 K	1.97 K	4.90 K	5.16 K	7.34 K	0.00	7.34 K
TC_Open Large Calendar	1.93 K	1.99 K	4.92 K	6.72 K	7.32 K	0.00	7.32 K
TC_Open Predefined Date	5.76 K	2.01 K	4.83 K	5.12 K	7.36 K	0.00	7.36 K
TC_Open Random Date	1.92 K	1.94 K	4.79 K	5.20 K	7.27 K	4.00	7.27 K
TC_Open Random page >1	149.00	906.71	4.07 K	4.53 K	6.88 K	5.00	6.89 K
TC_Open Random page >1	1.27 K	1.91 K	4.99 K	6.85 K	7.30 K	0.00	7.30 K
TC_Search by Name	5.77 K	2.04 K	4.83 K	5.05 K	7.35 K	8.00	7.35 K
TC_start_Open Home page	482.00	1.61 K	4.87 K	5.55 K	7.30 K	6.00	7.30 K
leave a comment	2.34 K	2.01 K	5.00 K	5.13 K	7.25 K	5.00	7.25 K

Table comparing changes in Average and NumberOfSamples for both cases.

Task 3 1000 posts					Task 6 1000 posts					Dif				
transaction	Average	Average (%)	NumberOfSamples	NumberOfSamples (%)	Average	Average (%)	NumberOfSamples	NumberOfSamples (%)	Average	Average (%)	NumberOfSamples	NumberOfSamples (%)		
TC_start_Open Home page	129.51	6%	403	2%	523.17	8%	230	1%	393.66	1%	-173	0%		
TC_Open Home page	178.09	9%	2940	11%	544	8%	1390	9%	365.91	-1%	-1550	-3%		
TC_Open Random Date	172.4	9%	3040	11%	567.42	8%	914	6%	395.02	0%	-2126	-6%		
TC_Open Predefined Date	173.72	9%	3060	12%	585.56	9%	2670	16%	411.84	0%	-390	5%		
TC_Search by Name	180.04	9%	2850	11%	590.12	9%	2720	17%	410.08	0%	-130	6%		
TC_Open Large Calendar	170.89	8%	2940	11%	500.69	7%	843	5%	329.8	-1%	-2097	-6%		
TC_Open Contacts	176.63	9%	2900	11%	473.01	7%	382	2%	296.38	-2%	-2518	-9%		
TC_Open Random page >1	171.54	8%	1340	5%	516.21	8%	611	4%	344.67	-1%	-729	-1%		
TC_Open Random page >1	90.19	4%	154	1%	235.97	4%	64	0%	145.78	-1%	-90	0%		
TC_Open first post	196.2	10%	2280	9%	614.04	9%	1820	11%	417.84	-1%	-460	3%		
TC_Open Random post	178.08	9%	2320	9%	582.96	9%	3600	22%	404.88	0%	1280	13%		
TC_leave a comment	203.58	10%	2320	9%	963.18	14%	1040	6%	759.6	4%	-1280	-2%		
	2020.87	100%	26547	100%	6696.33	100%	16284	100%						

Response time vs Active threads vs Throughput vs Error rate:



8.2. Comparing "Task 3" and "Task 6" results for 1000 posts

100 users, ramp-up 200 seconds, duration 300 seconds

	"Task 3" 1000 posts	Task 6 1000 posts
Capacity (users)	40	38
Throughput (successful transactions per second)	59	47
Capacity point (time)	10:30:50	10:16:25

In cases "Task 3" and "Task 6" for 1000 posts, the load model has also changed as described in paragraph 8.1. but it seems that the load model in this case no longer had such a significant impact. It seems that for a case with 1000 posts, the main influence was the large amount of data that the system operated on.

As can be seen in both cases for "Task 3" and "Task 6" for 1000 posts, the Capacity point is already reached at 38-40 users. The next test takes place under conditions of 100% CPU load.

Aggregate report Task 3 1000 posts:

transaction ^	NumberOfSamples	Average	pct90	pct95	pct99	Min	Max
TC_Open Contacts	1.03 K	1.45 K	4.53 K	5.42 K	5.91 K	5.00	5.91 K
TC_Open Home page	1.07 K	1.46 K	4.40 K	5.12 K	5.93 K	0.00	5.93 K
TC_Open Large Calendar	1.06 K	1.43 K	4.60 K	5.33 K	5.93 K	0.00	5.93 K
TC_Open Predefined Date	1.00 K	1.43 K	4.94 K	5.51 K	5.93 K	0.00	5.94 K
TC_Open Random Date	1.09 K	1.47 K	4.96 K	5.62 K	5.93 K	0.00	5.93 K
TC_Open Random page =1	117.00	489.06	2.83 K	3.37 K	5.34 K	6.00	5.34 K
TC_Open Random page >1	663.00	1.31 K	3.88 K	4.68 K	5.68 K	0.00	5.69 K
TC_Open Random post	1.06 K	1.57 K	5.15 K	5.69 K	6.03 K	0.00	6.04 K
TC_Open first post	1.04 K	1.59 K	4.84 K	5.41 K	5.72 K	0.00	5.72 K
TC_Search by Name	1.06 K	1.50 K	4.61 K	5.47 K	5.88 K	0.00	5.89 K
TC_leave a comment	1.06 K	1.53 K	4.67 K	5.61 K	5.97 K	0.00	5.97 K
TC_start_Open Home page	173.00	686.66	2.83 K	3.63 K	4.90 K	7.00	4.90 K

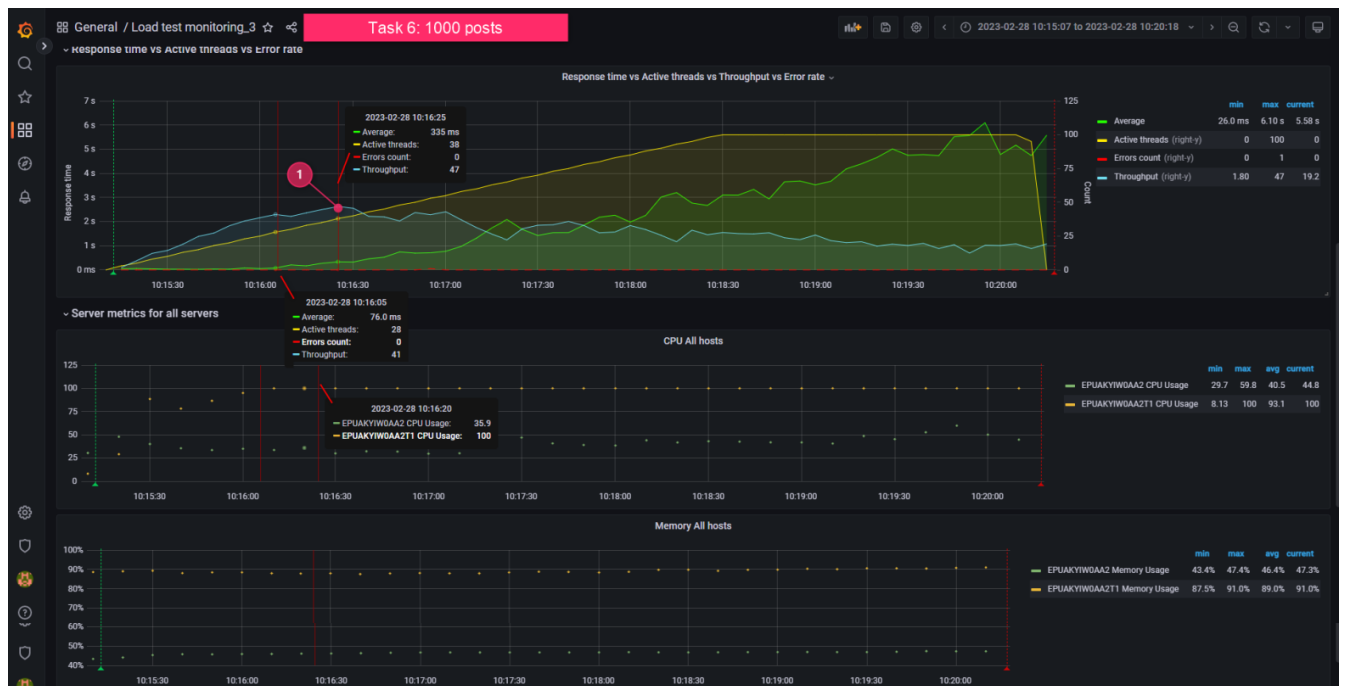
Aggregate report Task 6 1000 posts:

transaction ^	NumberOfSamples	Average	pct90	pct95	pct99	Min	Max	Error Count
Open Random post	1.90 K	2.17 K	5.80 K	6.67 K	6.92 K	7.00	7.01 K	-
Open first post	961.00	2.06 K	5.77 K	6.39 K	7.32 K	8.00	7.33 K	-
TC_Open Contacts	171.00	1.05 K	4.24 K	5.29 K	6.38 K	6.00	6.38 K	-
TC_Open Home page	711.00	1.86 K	5.08 K	5.94 K	6.41 K	8.00	6.41 K	-
TC_Open Large Calendar	471.00	1.69 K	4.76 K	5.76 K	6.39 K	0.00	6.40 K	-
TC_Open Predefined Date	1.26 K	1.98 K	5.36 K	6.31 K	6.47 K	6.00	6.47 K	-
TC_Open Random Date	421.00	1.62 K	5.00 K	5.65 K	6.19 K	7.00	6.20 K	-
TC_Open Random page =1	50.00	649.55	3.80 K	4.51 K	6.41 K	10.00	6.41 K	-
TC_Open Random page >1	376.00	1.49 K	4.75 K	6.11 K	6.44 K	7.00	6.45 K	-
TC_Search by Name	1.31 K	2.10 K	5.22 K	6.28 K	6.54 K	0.00	6.54 K	-
TC_start_Open Home page	142.00	623.64	3.09 K	4.43 K	6.29 K	9.00	6.29 K	-
leave a comment	579.00	1.84 K	5.04 K	5.93 K	6.40 K	7.00	6.40 K	1.00

Table comparing changes in Average and NumberOfSamples for both cases.

Transaction	Task 3 1000 posts				Task 6 1000 posts				Dif			
	Average	Average (%)	NumberOf Samples	NumberOf Samples (%)	Average	Average (%)	NumberOf Samples	NumberOf Samples (%)	Average	Average (%)	NumberOf Samples	NumberOf Samples (%)
TC_start_Open Home page	686.66	4%	173	2%	623.64	3%	142	2%	-63.02	-1%	-31	0%
TC_Open Home page	1460	9%	1070	10%	1860	10%	711	9%	400	1%	-359	-2%
TC_Open Random Date	1470	9%	1090	10%	1620	8%	421	5%	150	-1%	-669	-5%
TC_Open Predefined Date	1430	9%	1000	10%	1980	10%	1260	15%	550	1%	260	5%
TC_Search by Name	1500	9%	1060	10%	2100	11%	1310	16%	600	2%	250	6%
TC_Open Large Calendar	1430	9%	1060	10%	1690	9%	471	6%	260	0%	-589	-5%
TC_Open Contacts	1450	9%	1030	10%	1050	5%	171	2%	-400	-4%	-859	-8%
TC_Open Random page >1	1310	8%	663	6%	1490	8%	376	5%	180	0%	-287	-2%
TC_Open Random page =1	489.06	3%	117	1%	649.55	3%	50	1%	160.49	0%	-67	-1%
TC_Open first post	1590	10%	1040	10%	2060	11%	961	12%	470	1%	-79	2%
TC_Open Random post	1570	10%	1060	10%	2170	11%	1900	23%	600	1%	840	13%
TC_leave a comment	1530	10%	1060	10%	1840	10%	579	7%	310	0%	-481	-3%
	15315.72	100%	10423	100%	19133.19	100%	8352	100%				

Response time vs Active threads vs Throughput vs Error rate:



8.3. Comparing "Task 6" for 100 posts and for 1000 posts

100 users, ramp-up 200 seconds, duration 300 seconds

	"Task 6" 100 posts	Task 6 1000 posts
Capacity (users)	53	38
Throughput (successful transactions per second)	81.8	47
Capacity point (time)	10:43:45	10:16:25

In the "Task 6" cases for 100 and 1000 posts, the load model is maximally similar, except for the case with 1000 posts, the probability of having a post is the same for "Open Random Date" and "Open Predefined Date".

It seems that for the case with 100 and 1000 posts, the main influence on the achievement of the Capacity of the point was the large amount of data that the system operated for the case with 1000 posts.

Aggregate report Task 6 for 100 posts:

transaction ^	NumberOfSamples	Average	pct90	pct95	pct99	Min	Max
Open Random post	7.49 K	2.05 K	4.71 K	5.67 K	7.30 K	5.00	7.30 K
Open first post	4.00 K	2.07 K	5.06 K	5.43 K	7.34 K	5.00	7.34 K
TC_Open Contacts	791.00	1.84 K	4.90 K	5.08 K	6.61 K	4.00	6.61 K
TC_Open Home page	2.86 K	1.97 K	4.90 K	5.16 K	7.34 K	0.00	7.34 K
TC_Open Large Calendar	1.93 K	1.99 K	4.92 K	6.72 K	7.32 K	0.00	7.32 K
TC_Open Predefined Date	5.76 K	2.01 K	4.83 K	5.12 K	7.36 K	0.00	7.36 K
TC_Open Random Date	1.92 K	1.94 K	4.79 K	5.20 K	7.27 K	4.00	7.27 K
TC_Open Random page =1	149.00	906.71	4.07 K	4.53 K	6.88 K	5.00	6.89 K
TC_Open Random page >1	1.27 K	1.91 K	4.99 K	6.85 K	7.30 K	0.00	7.30 K
TC_Search by Name	5.77 K	2.04 K	4.83 K	5.05 K	7.35 K	8.00	7.35 K
TC_start_Open Home page	482.00	1.61 K	4.87 K	5.55 K	7.30 K	6.00	7.30 K
leave a comment	2.34 K	2.01 K	5.00 K	5.13 K	7.25 K	5.00	7.25 K

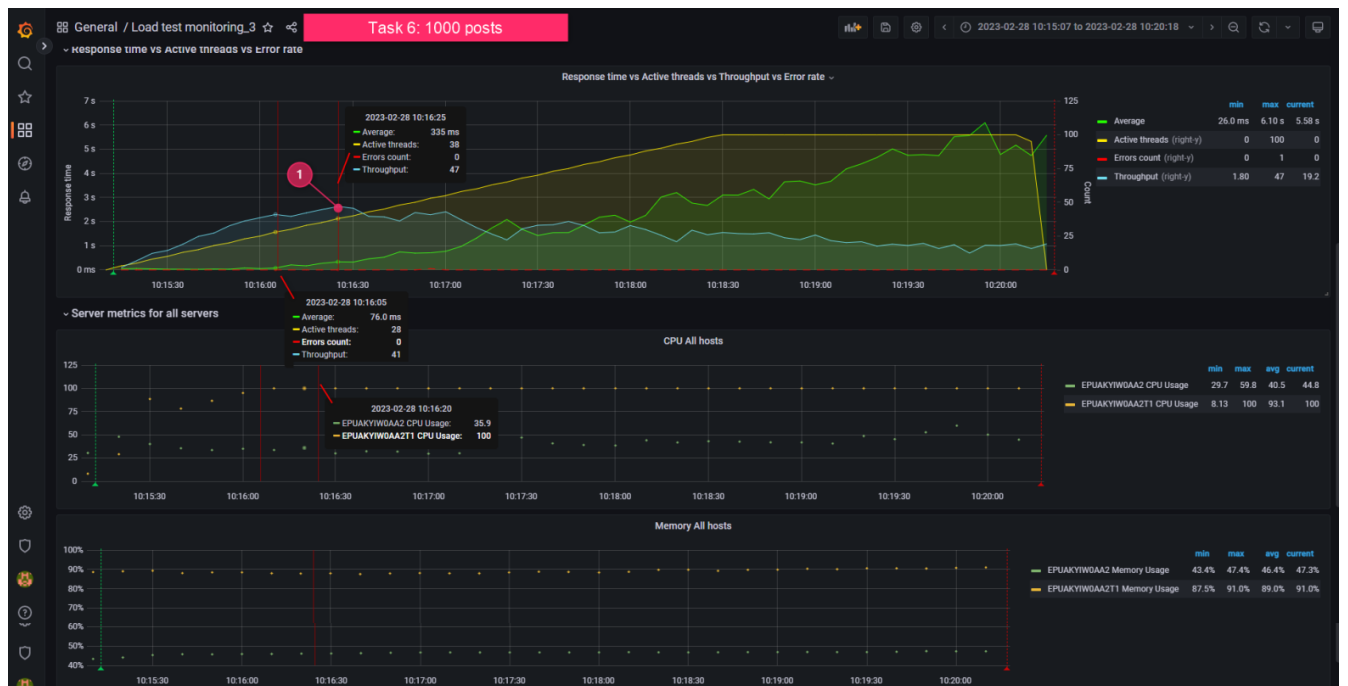
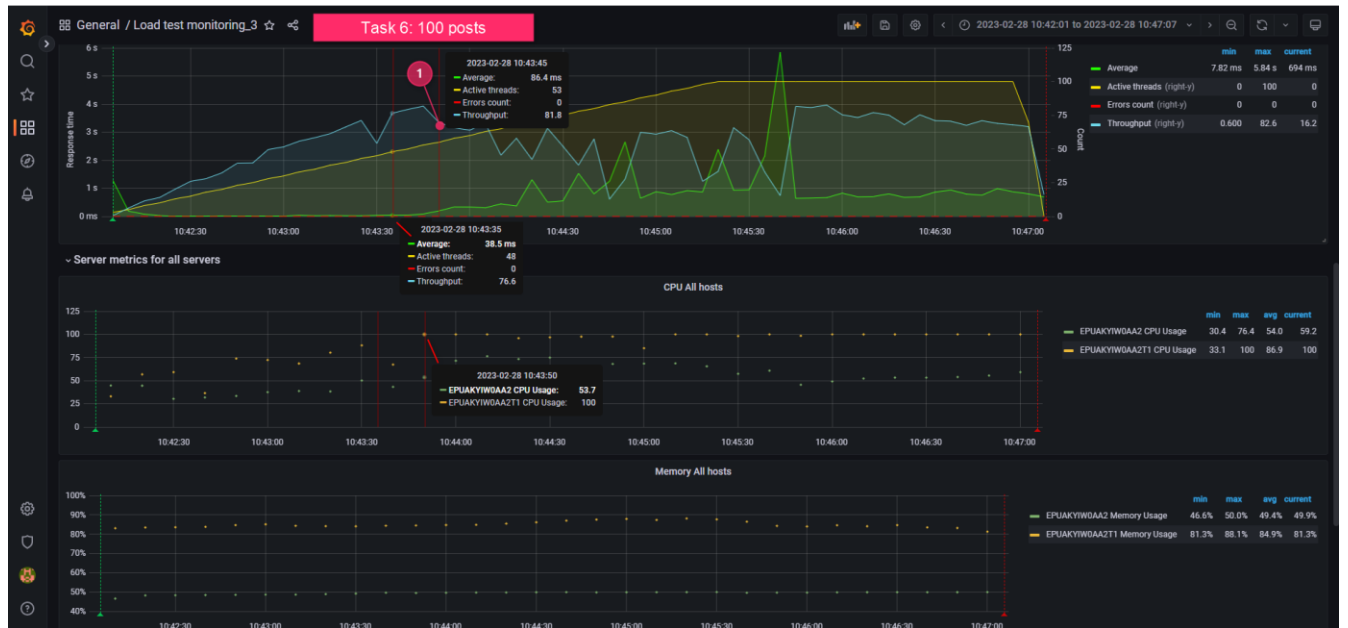
Aggregate report Task 6 1000 posts:

transaction ^	NumberOfSamples	Average	pct90	pct95	pct99	Min	Max	Error Count
Open Random post	1.90 K	2.17 K	5.80 K	6.67 K	6.92 K	7.00	7.01 K	-
Open first post	961.00	2.06 K	5.77 K	6.39 K	7.32 K	8.00	7.33 K	-
TC_Open Contacts	171.00	1.05 K	4.24 K	5.29 K	6.38 K	6.00	6.38 K	-
TC_Open Home page	711.00	1.86 K	5.08 K	5.94 K	6.41 K	8.00	6.41 K	-
TC_Open Large Calendar	471.00	1.69 K	4.76 K	5.76 K	6.39 K	0.00	6.40 K	-
TC_Open Predefined Date	1.26 K	1.98 K	5.36 K	6.31 K	6.47 K	6.00	6.47 K	-
TC_Open Random Date	421.00	1.62 K	5.00 K	5.65 K	6.19 K	7.00	6.20 K	-
TC_Open Random page =1	50.00	649.55	3.80 K	4.51 K	6.41 K	10.00	6.41 K	-
TC_Open Random page >1	376.00	1.49 K	4.75 K	6.11 K	6.44 K	7.00	6.45 K	-
TC_Search by Name	1.31 K	2.10 K	5.22 K	6.28 K	6.54 K	0.00	6.54 K	-
TC_start_Open Home page	142.00	623.64	3.09 K	4.43 K	6.29 K	9.00	6.29 K	-
leave a comment	579.00	1.84 K	5.04 K	5.93 K	6.40 K	7.00	6.40 K	1.00

Table comparing changes in Average and NumberOfSamples for both cases.

transaction	Task 6 100 posts				Task 6 1000 posts				Dif			
	Average	Average (%)	NumberOf Samples	NumberOf Samples (%)	Average	Average (%)	NumberOf Samples	NumberOf Samples (%)	Average	Average (%)	NumberOf Samples	NumberOf Samples (%)
TC_start_Open Home page	523.17	8%	230	1%	623.64	3%	142	2%	100.47	-5%	-88	0%
TC_Open Home page	544	8%	1390	9%	1860	10%	711	9%	1316	2%	-679	0%
TC_Open Random Date	567.42	8%	914	6%	1620	8%	421	5%	1052.58	0%	-493	-1%
TC_Open Predefined Date	585.56	9%	2670	16%	1980	10%	1260	15%	1394.44	2%	-1410	-1%
TC_Search by Name	590.12	9%	2720	17%	2100	11%	1310	16%	1509.88	2%	-1410	-1%
TC_Open Large Calendar	500.63	7%	843	5%	1690	9%	471	6%	1189.31	1%	-372	0%
TC_Open Contacts	473.01	7%	382	2%	1050	5%	171	2%	576.99	-2%	-211	0%
TC_Open Random page >1	516.21	8%	611	4%	1490	8%	376	5%	973.79	0%	-235	1%
TC_Open Random page =1	235.97	4%	64	0%	649.55	3%	50	1%	413.58	0%	-14	0%
TC_Open first post	614.04	9%	1820	11%	2060	11%	961	12%	1445.96	2%	-859	0%
TC_Open Random post	582.96	9%	3600	22%	2170	11%	1900	23%	1587.04	3%	-1700	1%
TC_leave a comment	963.18	14%	1040	6%	1840	10%	579	7%	876.82	-5%	-461	1%
	6696.33	100%	16284	100%	19133.19	100%	8352	100%				

Response time vs Active threads vs Throughput vs Error rate:



Links to source data:

	HW3	HW6
	-JUSERS=100 -JRAMPUP=200 -JDURATION=300 -JCONSTANT_DELAY=500 -JDEVIATION_DELAY=250 -JCOMMENT_CONSTANT_DELAY=1000	
100 posts	http://localhost:3000/d/rxKcwpFmk_3/load-test-monitoring_3?orgId=1&from=1677568869585&to=1677569175194&var-group_time=5s&var-metric=All&var-scenario=All&var-transactions=All&var-server_measurements=All&var-host=All&var-measurement=jmeter http://localhost:8080/job/Load%20Test%20Hello%20world%20(HW3)/16/	http://localhost:3000/d/rxKcwpFmk_3/load-test-monitoring_3?orgId=1&from=1677573721312&to=1677574027116&var-group_time=5s&var-metric=All&var-scenario=All&var-transactions=All&var-server_measurements=All&var-host=All&var-measurement=jmeter http://localhost:8080/job/Load%20Test%20Hello%20world%20(HW6)/7/
1000 posts	http://localhost:3000/d/rxKcwpFmk_3/load-test-monitoring_3?orgId=1&from=1677572968270&to=1677573276602&var-group_time=5s&var-metric=All&var-scenario=All&var-transactions=All&var-server_measurements=All&var-host=All&var-measurement=jmeter http://localhost:8080/job/Load%20Test%20Hello%20world%20(HW3)/17/	http://localhost:3000/d/rxKcwpFmk_3/load-test-monitoring_3?orgId=1&from=1677572107902&to=1677572418134&var-group_time=5s&var-metric=All&var-scenario=All&var-transactions=All&var-server_measurements=All&var-host=All&var-measurement=jmeter http://localhost:8080/job/Load%20Test%20Hello%20world%20(HW6)/6/