

Preparació per realitzar l'anàlisi de dades

Per realitzar la primer tasca, he buscat els *flags* de la comanda *docker run* per poder modificar la quantitat de peticons i el nivell de concurrència (-n, -c). Seguidament, utilitzant el web server *nginx* configurat amb una concurrència d'una CPU i amb un nombre considerable de peticions, a l'executar l'*Apache ab* he obtingut les dades següents:

```
guillem@guillem-SATELLITE-P70-B:~/proba/docker-ab$
guillem@guillem-SATELLITE-P70-B:~/proba/docker-ab$ docker run --rm jordi/ab -n 400 -c 1 https://www.docker.com/
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Benchmarking www.docker.com (be patient)
Completed 100 requests
Completed 200 requests
Completed 300 requests
Completed 400 requests
Finished 400 requests

Server Software:      nginx
Server Hostname:      www.docker.com
Server Port:          443
SSL/TLS Protocol:     TLSv1.2,ECDHE-RSA-AES128-GCM-SHA256,2048,128
TLS Server Name:      www.docker.com

Document Path:        /
Document Length:      73127 bytes

Concurrency Level:     1
Time taken for tests:   38.968 seconds
Complete requests:     400
Failed requests:        0
Total transferred:     29625600 bytes
HTML transferred:      29250800 bytes
Requests per second:   10.26 [#/sec] (mean)
Time per request:      97.420 [ms] (mean)
Time per request:      97.420 [ms] (mean, across all concurrent requests)
Transfer rate:         742.44 [Kbytes/sec] received

Connection Times (ms)
  min   mean[+/-sd] median   max
Connect:  47    56  10.1    53    130
Processing:  35    41   6.9    39    86
Waiting:    15    20   5.4    19    58
Total:      84    97  14.4    93   185

Percentage of the requests served within a certain time (ms)
 50%    93
 66%    96
 75%    98
 80%   101
 90%   111
 95%   124
 98%   155
 99%   170
100%   185 (longest request)
guillem@guillem-SATELLITE-P70-B:~/proba/docker-ab$
```

Primerament cal destacar les dades obtingudes referents al nombre de CPUs utilitzats. Aquest nombre el podem veure al paràmetre "Concurrency Level". El següent paràmetre rellevant és aquell que ens ajuda a veure el TPS que hem tingut en les nostres peticions. Aquest, el podem veure en el paràmetre "Request per second".

Un cop adquirits aquests coneixements, vaig procedir a realitzar proves variant el nombre de CPUs utilitzats (augmentant així la concurrència) per intentar trobar la configuració òptima per obtenir el millor rendiment de la relació ús de la CPU-Transaccions Per Segon. Abans de realitzar proves, vaig fer la premissa següent:

"El valor del TPS augmentarà a mesura que augmentem la concurrència i l'ús de CPU augmentarà poc a poc fins que arribi el punt que el TPS ja no pujarà o l'augment d'aquest no pujarà el suficient per compensar l'augment de l'ús de la CPU. D'aquesta manera, trobant el punt d'inflexió, obtindrem la configuració òptima".

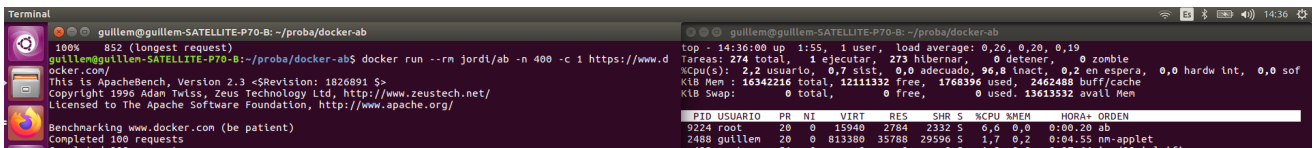
A més a més, vaig comprovar el nombre de CPUs del meu ordinador. Aquest és de 4 i, per tant, el meu ordinador té 8 threads.

```
processor      : 6
vendor_id     : GenuineIntel
cpu family    : 6
model         : 60
model name    : Intel(R) Core(TM) i7-4720HQ CPU @ 2.60GHz
stepping      : 3
microcode     : 0x27
cpu MHz       : 1401.460
cache size    : 6144 KB
physical id   : 0
siblings      : 8
core id       : 3
cpu cores     : 4
```

Realització de Proves

A continuació, adjunto les proves realitzades més rellevants:

400 peticions i concurrència 1



```
Terminal
guillem@guillem-SATELLITE-P70-B: ~/proba/docker-ab
100% 852 (longest request)
guillem@guillem-SATELLITE-P70-B:~/proba/docker-ab$ docker run --rm jordi/ab -n 400 -c 1 https://www.d
ocker.com/
This is ApacheBench, Version 2.3 <$Revision: 1826891 $>
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Benchmarking www.docker.com (be patient)
Completed 100 requests
Completed 200 requests
Completed 300 requests
Completed 400 requests
Finished 400 requests

top - 14:36:00 up 1:55, 1 user, load average: 0.26, 0.20, 0.19
Tasks: 274 total, 1 ejecutar, 273 hibernar, 0 detener, 0 zombie
%Cpu(s): 2,2 usario, 0,7 sist, 0,0 adecuado, 96,8 inact, 0,2 en espera, 0,0 hardw int, 0,0 sof
KlB Mem : 16342216 total, 12111332 free, 1768396 used, 2462488 buff/cache
KlB Swap: 0 total, 0 free, 0 used, 13613532 avail Mem

PID USUARIO PR NI VIRT RES SHR S %CPU %MEM HORA+ ORDEN
9224 root 20 0 15940 2784 2332 S 0,6 0,0 0:00.20 ab
2480 guillem 20 0 813380 35780 29596 S 1,7 0,2 0:04.55 nm-applet
433 root 51 0 0 0 0 0 S 0,0 0,0 0:07.64 top/35-101kifl
```

```
guillem@guillem-SATELLITE-P70-B:~/proba/docker-ab$ docker run --rm jordi/ab -n 400 -c 1 https://www.d
ocker.com/
This is ApacheBench, Version 2.3 <$Revision: 1826891 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking www.docker.com (be patient)
Completed 100 requests
Completed 200 requests
Completed 300 requests
Completed 400 requests
Finished 400 requests

Server Software:      nginx
Server Hostname:      www.docker.com
Server Port:          443
SSL/TLS Protocol:     TLSv1.2,ECDHE-RSA-AES128-GCM-SHA256,2048,128
TLS Server Name:      www.docker.com

Document Path:        /
Document Length:      73127 bytes

Concurrency Level:     1
Time taken for tests:  40.434 seconds
Complete requests:     400
Failed requests:        0
Total transferred:     29625600 bytes
HTML transferred:      29250800 bytes
Requests per second:   9.89 [#/sec] (mean)
Time per request:      101.084 [ms] (mean)
Time per request:      101.084 [ms] (mean, across all concurrent requests)
Transfer rate:         715.52 [Kbytes/sec] received

Connection Times (ms)
      min      mean[+/-sd] median   max
Connect:    47      57   11.3      53    130
Processing:  35      44   12.9      40    179
Waiting:    15      23   10.6      20    157
Total:       83     101   18.1      94    235

Percentage of the requests served within a certain time (ms)
 50%      94
 66%      99
 75%     105
 80%     110
 90%     124
 95%     137
 98%     156
 99%     176
100%     235 (longest request)
```

400 peticions i concurrència 4

```
Terminal
guillem@guillem-SATELLITE-P70-B: ~/proba/docker-ab
guillem@guillem-SATELLITE-P70-B:~/proba/docker-ab$ docker run --rm jordi/ab -n 400 -c 4 https://www.d
ocker.com/
This is ApacheBench, Version 2.3 <Revision: 1826891>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
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Benchmarking www.docker.com (be patient)
Completed 100 requests
```

```
guillem@guillem-SATELLITE-P70-B:~/proba/docker-ab$ docker run --rm jordi/ab -n 400 -c 4 https://www.d
ocker.com/
This is ApacheBench, Version 2.3 <Revision: 1826891>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking www.docker.com (be patient)
Completed 100 requests
Completed 200 requests
Completed 300 requests
Completed 400 requests
Finished 400 requests

Server Software:      nginx
Server Hostname:      www.docker.com
Server Port:          443
SSL/TLS Protocol:     TLSv1.2, ECDHE-RSA-AES128-GCM-SHA256, 2048, 128
TLS Server Name:      www.docker.com

Document Path:        /
Document Length:       73127 bytes

Concurrency Level:     4
Time taken for tests:   10.668 seconds
Complete requests:      400
Failed requests:         0
Total transferred:      29625600 bytes
HTML transferred:       29250800 bytes
Requests per second:    37.49 [#/sec] (mean)
Time per request:       106.682 [ms] (mean)
Time per request:       26.671 [ms] (mean, across all concurrent requests)
Transfer rate:          2711.91 [Kbytes/sec] received

Connection Times (ms)
      min      mean[+/-sd]  median    max
Connect:    45      59  16.7      53    272
Processing:  35      45   9.4      41    102
Waiting:    14      22   7.3      20     78
Total:       83     104  22.0      96    344

Percentage of the requests served within a certain time (ms)
 50%      96
 66%     101
 75%     108
 80%     113
 90%     126
 95%     141
 98%     169
 99%     181
100%    344 (longest request)
```

400 peticions i concurrència 6

```
Terminal
guillem@guillem-SATELLITE-P70-B: ~/proba/docker-ab
docker.com/
This is ApacheBench, Version 2.3 <$Revision: 1826891 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking www.docker.com (be patient)
Completed 100 requests
Completed 200 requests
Completed 300 requests
Completed 400 requests
Finished 400 requests

top - 15:24:51 up 2:44, 1 user, load average: 0.12, 0.15, 0.18
rareas: 274 total, 1 ejecutar, 273 hibernar, 0 detener, 0 zombic
%cpu(s): 1.8 usuario, 0.8 sist, 0.0 adecuado, 97.1 inact, 0.1 en espera, 0.0 hardw int, 0.2 sof
KilB Mem : 16342216 total, 11828736 free, 1945044 used, 2568436 buff/cache
KilB Swap: 0 total, 0 free, 0 used, 13405460 avail Mem

PID USUARIO PR NI VIRT RES SHR S %CPU %MEM HORA+ ORDEN
12526 root 20 0 16464 3684 2580 S 14.0 0.0 0:00.66 ab
433 root -51 0 0 0 0 S 6.0 0.0 0:30.44 irq/33-tlwtfl
7010 guillem 20 0 2883164 340448 156880 S 1.3 2.1 3:00.36 Web content
2673 guillem 20 0 3651076 486328 200612 S 1.0 3.0 3:00.32 firefox
484 root 0 -20 0 0 0 S 0.7 0.0 0:01.08 kworker/u17:2
2451 guillem 20 0 1540512 237804 66022 S 0.7 1.5 1:50.04 cronit
```

```
guillem@guillem-SATELLITE-P70-B:~/proba/docker-ab$ docker run --rm jordi/ab -n 400 -c 6 https://www.d
docker.com/
This is ApacheBench, Version 2.3 <$Revision: 1826891 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking www.docker.com (be patient)
Completed 100 requests
Completed 200 requests
Completed 300 requests
Completed 400 requests
Finished 400 requests

Server Software:      nginx
Server Hostname:      www.docker.com
Server Port:          443
SSL/TLS Protocol:     TLSv1.2,ECDHE-RSA-AES128-GCM-SHA256,2048,128
TLS Server Name:      www.docker.com

Document Path:        /
Document Length:      73127 bytes

Concurrency Level:     6
Time taken for tests:  7.643 seconds
Complete requests:     400
Failed requests:       0
Total transferred:     29625200 bytes
HTML transferred:      29250800 bytes
Requests per second:   52.34 [#/sec] (mean)
Time per request:      114.639 [ms] (mean)
Time per request:      19.106 [ms] (mean, across all concurrent requests)
Transfer rate:         3785.48 [Kbytes/sec] received

Connection Times (ms)
      min    mean[+/-sd] median    max
Connect:    46     64  29.5      56    380
Processing:  35     47  13.4      42    182
Waiting:    14     25  11.8      21    160
Total:      83    111  35.7      99    439

Percentage of the requests served within a certain time (ms)
 50%    99
 66%   105
 75%   116
 80%   122
 90%   146
 95%   174
 98%   223
 99%   281
100%  439 (longest request)
```

400 peticions i concurrència 8

```
Terminal
guillem@guillem-SATELLITE-P70-B: ~/proba/docker-ab
guillem@guillem-SATELLITE-P70-B:~/proba/docker-ab$ docker run --rm jordi/ab -n 400 -c 8 https://www.d
docker.com/
This is ApacheBench, Version 2.3 <$Revision: 1826891 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
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Benchmarking www.docker.com (be patient)
Completed 100 requests
Completed 200 requests
Completed 300 requests
Completed 400 requests
Finished 400 requests

top - 14:14:26 up 1:34, 1 user, load average: 0.18, 0.17, 0.16
Tasks: 276 total, 1 ejecutar, 275 hibernar, 0 detener, 0 zombie
%Cpu(s): 2.3 usuario, 1.0 sist, 0.0 adecuado, 96.4 inact, 0.1 en espera, 0.0 hardw int, 0.3 sof
KlB Mem : 16342216 total, 12143872 free, 1800632 used, 2397712 buff/cache
KlB Swap: 0 total, 0 free, 0 used, 13587328 avail Mem

PID USUARIO PR NI VIRT RES SHR S %CPU %MEM HORA+ ORDEN
8128 root 20 0 16816 3624 2536 S 16.7 0.0 0:00.60 ab
433 root -51 0 0 0 0 S 7.3 0.0 0:04.98 irq/33-lwlwifl
7010 guillem 20 0 2823720 330280 137656 S 3.0 2.0 0:17.81 Web Content
463 root 0 -20 0 0 0 S 6.7 0.0 0:00.13 kworker/u17:0
7 root 20 0 0 0 0 S 0.3 0.0 0:01.16 rcu_sched
273 root 20 0 35436 6948 6460 S 0.3 0.0 0:00.50 systemd-journal
```

```
guillem@guillem-SATELLITE-P70-B:~/proba/docker-ab$ docker run --rm jordi/ab -n 400 -c 8 https://www.d
ocker.com/
This is ApacheBench, Version 2.3 <$Revision: 1826891 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking www.docker.com (be patient)
Completed 100 requests
Completed 200 requests
Completed 300 requests
Completed 400 requests
Finished 400 requests

Server Software:      nginx
Server Hostname:      www.docker.com
Server Port:          443
SSL/TLS Protocol:     TLSv1.2,ECDHE-RSA-AES128-GCM-SHA256,2048,128
TLS Server Name:      www.docker.com

Document Path:        /
Document Length:      73127 bytes

Concurrency Level:     8
Time taken for tests:   5.230 seconds
Complete requests:     400
Failed requests:        0
Total transferred:     29625600 bytes
HTML transferred:      29250800 bytes
Requests per second:    76.49 [#./sec] (mean)
Time per request:       104.595 [ms] (mean)
Time per request:       13.074 [ms] (mean, across all concurrent requests)
Transfer rate:          5532.04 [Kbytes/sec] received

Connection Times (ms)
      min      mean[+/-sd] median   max
Connect:    47      57   12.6     54    166
Processing:  35      45   10.0     42    119
Waiting:    14      22    7.4     20     87
Total:      83     102   17.9     97    241

Percentage of the requests served within a certain time (ms)
 50%      97
 66%     101
 75%     104
 80%     108
 90%     121
 95%     138
 98%     163
 99%     175
100%     241 (longest request)
```

4000 peticions i concurrència 16

```
Terminal
guillem@guillem-SATELLITE-P70-B: ~/proba/docker-ab
Completed 1600 requests
Completed 2000 requests
Completed 2400 requests
Completed 2800 requests
Completed 3200 requests
Completed 3600 requests
Completed 4000 requests
Finished 4000 requests

Server Software:      nginx
Server Hostname:      www.docker.com
Server Port:          443
SSL/TLS Protocol:     TLSv1.2,ECDHE-RSA-AES128-GCM-SHA256,2048,128
TLS Server Name:      www.docker.com

top - 14:46:50 up 2:06, 1 user, load average: 0.28, 0.34, 0.26
Tasks: 276 total, 2 ejecutar, 274 hibernar, 0 detener, 0 zombie
%Cpu(s):  6.1 usuario,  1.7 sist,  0.0 adecuado, 91.4 inact,  0.4 en espera,  0.0 hardw int,  0.5 sof
KiB Mem : 16342216 total, 11960208 free, 1863408 used, 2519600 buff/cache
KiB Swap:  0 total,  0 free,  0 used, 13499404 avail Mem

  PID USUARIO    PR  NI  VIRT  RES  SHR  S  %CPU  %MEM    time+  COMMAND
10720 root         20   0 17584 4484 2592 R   30.9   0.0   0:04.05 ab
433  root        -51   0   0     0   0   S    9.0   0.0   0:14.13 irq/33-twlwifi
7010 guillem     20   0 2874972 284388 156816 S    8.0   1.7   1:19.94 Web Content
1186 root         20   0 783008 191892 103840 S    3.3   1.2   2:56.53 Xorg
2451 guillem     20   0 1541776 238436 66300 S    2.0   1.5   1:31.61 complz
2318 guillem     20   0 961096 66636 26208 S    1.7   0.4   0:00.96 unity-settings-
484  root         0 -28   0     0   0   S    0.7   0.0   0:00.64 kworker/u17:2
463  root         0 -29   0     0   0   S    0.3   0.0   0:00.71 kworker/u17:0
1991 guillem     20   0 421660 8520 5692 S    0.3   0.1   0:17.62 dbus-daemon
```

```
100% 2261 (longest request)
guillem@guillem-SATELLITE-P70-B: ~/proba/docker-ab$ docker run --rm jordi/ab -n 4000 -c 16 https://www
.docker.com/
This is ApacheBench, Version 2.3 <$Revision: 1826891 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking www.docker.com (be patient)
Completed 400 requests
Completed 800 requests
Completed 1200 requests
Completed 1600 requests
Completed 2000 requests
Completed 2400 requests
Completed 2800 requests
Completed 3200 requests
Completed 3600 requests
Completed 4000 requests
Finished 4000 requests

Server Software:      nginx
Server Hostname:      www.docker.com
Server Port:          443
SSL/TLS Protocol:     TLSv1.2,ECDHE-RSA-AES128-GCM-SHA256,2048,128
TLS Server Name:      www.docker.com

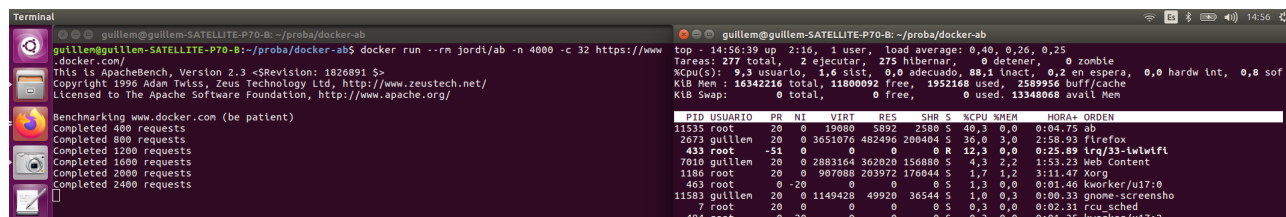
Document Path:        /
Document Length:       73127 bytes

Concurrency Level:     16
Time taken for tests:   28.725 seconds
Complete requests:     4000
Failed requests:        0
Total transferred:     296248000 bytes
HTML transferred:      292508000 bytes
Requests per second:   139.25 [#/sec] (mean)
Time per request:      114.899 [ms] (mean)
Time per request:      7.181 [ms] (mean, across all concurrent requests)
Transfer rate:         10071.60 [Kbytes/sec] received

Connection Times (ms)
      min      mean[+/-sd]  median    max
Connect:    46       64  22.3      60    597
Processing:  36       50  11.4      47    260
Waiting:    13       23   9.1      21    240
Total:       86      114  27.6     107    654

Percentage of the requests served within a certain time (ms)
 50%    107
 66%    113
 75%    119
 80%    123
 90%    137
 95%    154
 98%    181
 99%    211
100%    654 (longest request)
```


4000 peticions i concurrència 32



```
guillem@guillem-SATELLITE-P70-B: ~/proba/docker-ab
guillem@guillem-SATELLITE-P70-B:~/proba/docker-ab$ docker run --rm jordi/ab -n 4000 -c 32 https://www
.docker.com/
This is ApacheBench, Version 2.3 <$Revision: 1826891 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking www.docker.com (be patient)
Completed 400 requests
Completed 800 requests
Completed 1200 requests
Completed 1600 requests
Completed 2000 requests
Completed 2400 requests
Completed 2800 requests
Completed 3200 requests
Completed 3600 requests
Completed 4000 requests
Finished 4000 requests

Server Software:      nginx
Server Hostname:      www.docker.com
Server Port:          443
SSL/TLS Protocol:     TLSv1.2,ECDHE-RSA-AES128-GCM-SHA256,2048,128
TLS Server Name:      www.docker.com

Document Path:        /
Document Length:      73127 bytes

Concurrency Level:    32
Time taken for tests:  20.204 seconds
Complete requests:    4000
Failed requests:       0
Total transferred:    296248000 bytes
HTML transferred:     292508000 bytes
Requests per second:  197.98 [#/sec] (mean)
Time per request:     161.632 [ms] (mean)
Time per request:     5.051 [ms] (mean, across all concurrent requests)
Transfer rate:        14319.22 [Kbytes/sec] received

Connection Times (ms)
      min   mean[+/-sd] median   max
Connect:    51    88  27.6      83   677
Processing:  38    72  19.2      71   347
Waiting:    13    29  11.9      25   313
Total:      95   160  35.4     156   736

Percentage of the requests served within a certain time (ms)
 50%    156
 66%    168
 75%    176
 80%    181
 90%    199
 95%    216
 98%    245
 99%    269
100%    736 (longest request)
```


4000 peticions i concurrència 4000

```
Terminal
guillem@guillem-SATELLITE-P70-B: ~/proba/docker-ab
Benchmarking www.docker.com (be patient)
Completed 400 requests
Completed 800 requests
Completed 1200 requests
Completed 1600 requests
Completed 2000 requests
Completed 2400 requests
Completed 2800 requests
Completed 3200 requests
Completed 3600 requests
Completed 4000 requests
Finished 4000 requests
Server Software:      nginx
Server Hostname:      www.docker.com

top - 14:50:24 up 2:10, 1 user, load average: 0.26, 0.28, 0.26
Tasks: 273 total, 1 ejecutar, 272 hibernar, 0 detener, 0 zombie
Cpu(s): 7.5 usurto, 1.9 sist, 0.0 adecuado, 89.7 inact, 0.2 en espera, 0.0 hardw int, 0.6 sof
KlB Mem : 16342216 total, 11789792 free, 1988160 used, 2564264 buff/cache
KlB Swap: 0 total, 0 free, 0 used, 13338872 avail Mem

  PID USUARIO    PR  NI   VIRT   RES   SHR  S  %CPU  %MEM    TIME+  ORDEN
10988 root        20    0 144264 109980 2536  S   55.8   0.7   0:01.68   ab
433 root         -51    0      0      0      0  S   10.3   0.0   0:15.85 lrq/33-lwlwfl
7010 guillem    20    0 2883164 318948 156880  S    4.0   2.0   1:32.93 Web Content
10927 guillem    20    0 674784 50252 30160  S    1.3   0.3   0:00.07 docker
484 root         0 -20    0      0      0  S    1.0   0.0   0:00.77 kworker/u17:2
463 root         0 -20    0      0      0  S    0.7   0.0   0:00.84 kworker/u17:0
957 message+    20    0 44308 5236 3556  S    0.7   0.0   0:03.10 dbus-daemon
1237 root        20    0 948596 80760 40172  S    0.7   0.5   0:04.45 dockerd
2530 guillem    20    0 368772 7936 6792  S    0.7   0.0   0:00.74 gvfs-udisks2-vo
```

```
guillem@guillem-SATELLITE-P70-B:~/proba/docker-ab$ docker run --rm jordi/ab -n 4000 -c 4000 https://w
ww.docker.com/
This is ApacheBench, Version 2.3 <$Revision: 1826891 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking www.docker.com (be patient)
Completed 400 requests
Completed 800 requests
Completed 1200 requests
Completed 1600 requests
Completed 2000 requests
Completed 2400 requests
Completed 2800 requests
Completed 3200 requests
Completed 3600 requests
Completed 4000 requests
Finished 4000 requests

Server Software:      nginx
Server Hostname:      www.docker.com
Server Port:          443
SSL/TLS Protocol:     TLSv1.2,ECDHE-RSA-AES128-GCM-SHA256,2048,128
TLS Server Name:      www.docker.com

Document Path:        /
Document Length:      73127 bytes

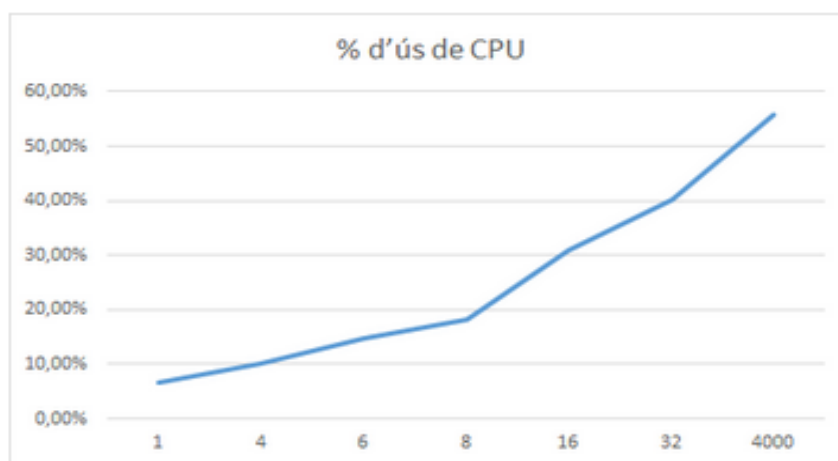
Concurrency Level:     4000
Time taken for tests:   42.666 seconds
Complete requests:     4000
Failed requests:        268
  (Connect: 0, Receive: 0, Length: 268, Exceptions: 0)
Total transferred:     287906162 bytes
HTML transferred:      284169902 bytes
Requests per second:   93.75 [#/sec] (mean)
Time per request:      42666.132 [ms] (mean)
Time per request:      10.667 [ms] (mean, across all concurrent requests)
Transfer rate:         6589.73 [Kbytes/sec] received

Connection Times (ms)
      min      mean[+/-sd] median   max
Connect:    0  4155 3903.3    2911  15974
Processing:  44  4047 9221.0    1122  41462
Waiting:    0   492  727.6     207  12607
Total:      167  8202 9079.9    5311  41462

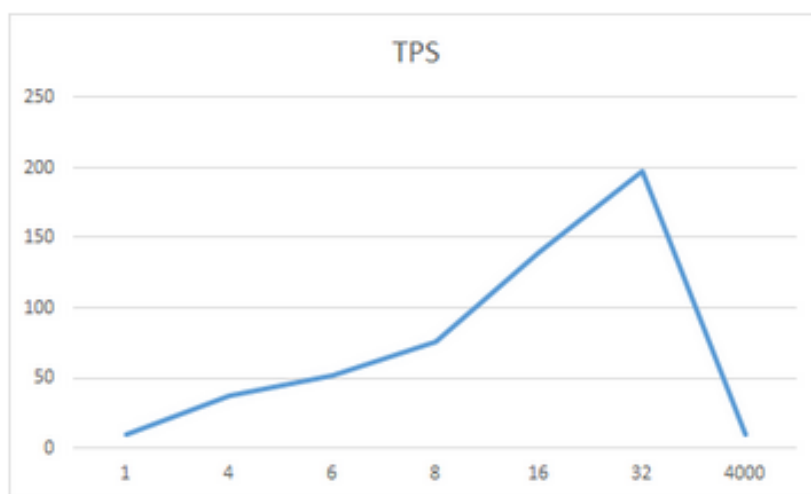
Percentage of the requests served within a certain time (ms)
 50%    5311
 66%    7723
 75%    9750
 80%   11301
 90%   16542
 95%   35149
 98%   39296
 99%   40648
100%   41462 (longest request)
```

Resultats Obtinguts:

No Peticions	Nivell de Concurrencia	TPS	% d'ús de CPU	Peticions Fallides
400	1	9,89 req/seg	6,6%	0
400	4	37,49 req/seg	10,0%	0
400	6	52,34 req/seg	14,0%	0
400	8	76,49 req/seg	18,3%	0
4000	16	139,25 req/seg	30,9%	0
4000	32	197,98req/seg	40,3%	0
4000	4000	93,7 req/seg	55,8%	268



Gràfic de l'evolució de l'ús de CPU en relació al nivell de concurrència



Gràfic de l'evolució del TPS en relació al nivell de concurrència

Conclusions

Amb l'ajuda d'aquesta taula i gràfics dels resultats obtinguts veig que la premissa inicial no anava massa desencaminada. Es pot observar que el valor del TPS i de l'ús de la CPU augmenten de diferent mesura segons la concurrència que apliquem i veiem dos punts de tall, un en el 4 i l'altre en els nombres enormes de threads.

Analitzant detingudament les dades, podem extreure les següents conclusions:

- La configuració **òptima** està en la **concurrència = 4** (4 *threads*), ja que és el punt on el percentatge de CPU que augmenta es molt inferior a la quantitat de TPS que obtenim. A partir dels 5 *threads*, la quantitat de TPS i de CPU augmenta en una relació directament proporcional amb l'augment del nombre de *threads* que utilitzem.
- Quan posem un **nombre molt considerable** de *threads*, és quan comencen a aparèixer els **errors**. Això podria ser degut a que com l'ordinador només té 4 CPUs. Suposant que les peticions que tenen un **temps límit** per executar-se, hi haurà threads, dels que hem assignat a una petició, que trigaran molt a poder executar-se, fet el qual podria ser degut a la disponibilitat de la CPU amb tants *threads*, els quals acaben sense haver pogut dur a terme la seva feina assignada.
- Quan tenim un nombre enorme de *threads*, a part d'aparèixer errors, l'ús de la CPU es dispara però baixa molt considerablement el TPS.