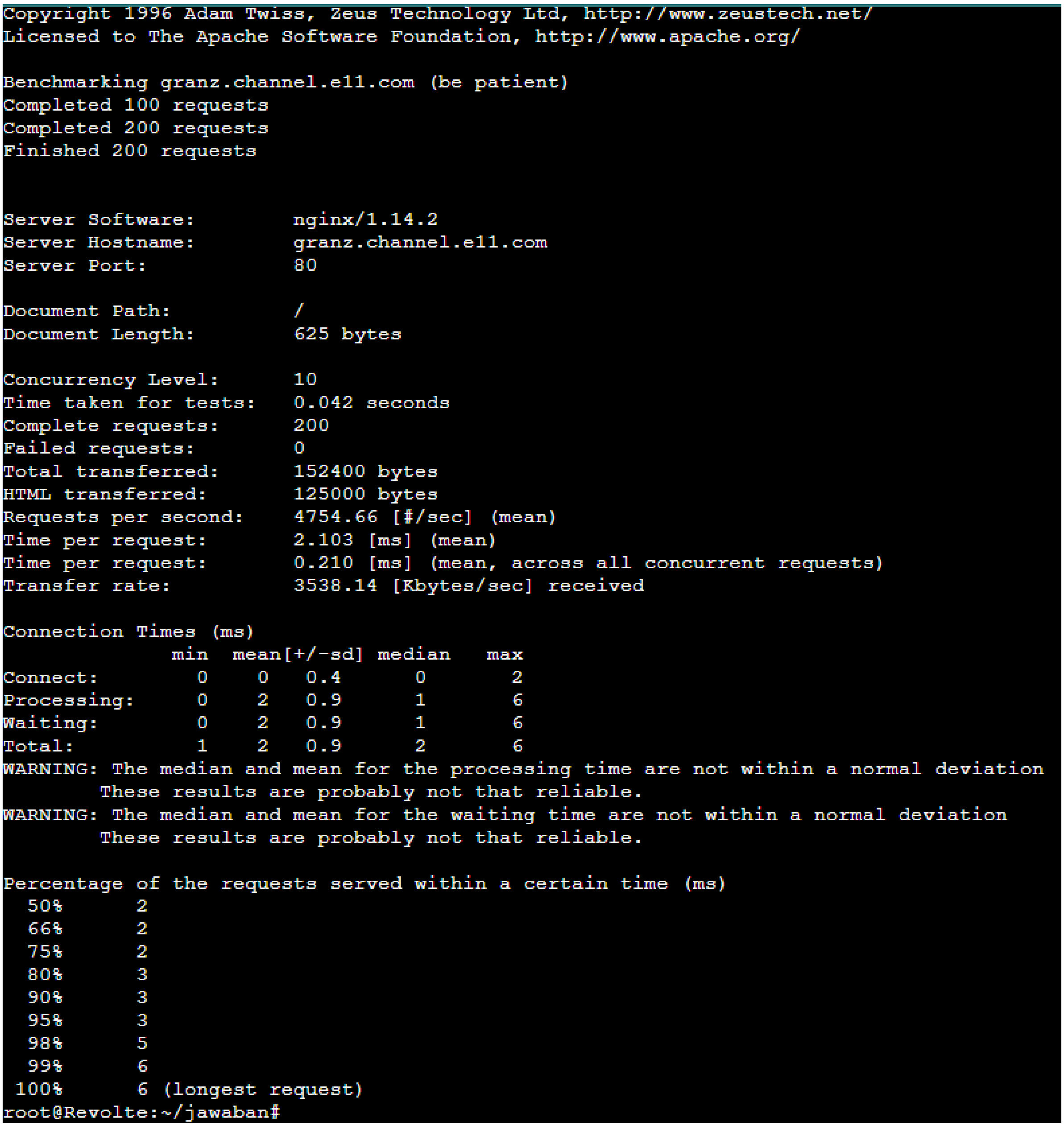
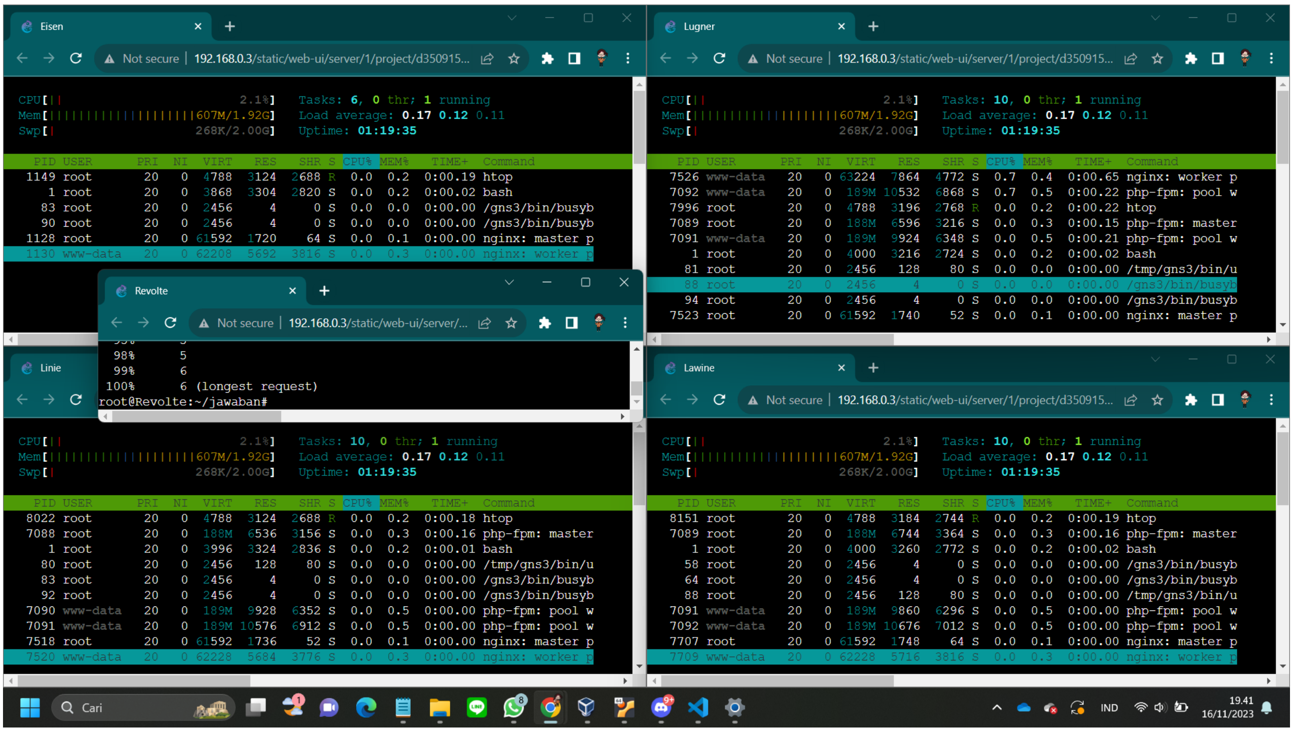
Kelompok = E11
Anggota = Sarah Nurhasna Khairunnisa (5025211105)
Tsabita Putri Ramadhany (5025211130)

Analisis Algoritma Load Balancer

1. **Default Round Robin**
   a. **Report hasil testing pada Apache Benchmark**



```
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking granz.channel.e11.com (be patient)
Completed 100 requests
Completed 200 requests
Finished 200 requests


Server Software:        nginx/1.14.2
Server Hostname:        granz.channel.e11.com
Server Port:            80

Document Path:          /
Document Length:        625 bytes

Concurrency Level:      10
Time taken for tests:   0.042 seconds
Complete requests:      200
Failed requests:        0
Total transferred:      152400 bytes
HTML transferred:       125000 bytes
Requests per second:    4754.66 [#/sec] (mean)
Time per request:       2.103 [ms] (mean)
Time per request:       0.210 [ms] (mean, across all concurrent requests)
Transfer rate:          3538.14 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0   0.4      0       2
Processing:     0    2   0.9      1       6
Waiting:        0    2   0.9      1       6
Total:          1    2   0.9      2       6
WARNING: The median and mean for the processing time are not within a normal deviation
        These results are probably not that reliable.
WARNING: The median and mean for the waiting time are not within a normal deviation
        These results are probably not that reliable.

Percentage of the requests served within a certain time (ms)
  50%      2
  66%      2
  75%      2
  80%      3
  90%      3
  95%      3
  98%      5
  99%      6
 100%      6 (longest request)
root@Revolte:~/jawaban#
```


Eisen
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...
Lugner
Revolte
Not secure | 192.168.0.3/static/web-ui/server/...
Linie
Lawine
Cari
IND
19.41
16/11/2023

Eisen:

```
CPU[||                       2.1%]   Tasks: 6, 0 thr; 1 running
Mem[||||||||||||||||||||607M/1.92G]   Load average: 0.17 0.12 0.11
Swp[|                  268K/2.00G]   Uptime: 01:19:35

  PID USER       PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 1149 root        20   0  4788  3124  2688 R  0.0  0.2  0:00.19 htop
    1 root        20   0  3868  3304  2820 S  0.0  0.2  0:00.02 bash
   83 root        20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   90 root        20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 1128 root        20   0 61592  1720    64 S  0.0  0.1  0:00.00 nginx: master p
 1130 www-data    20   0 62208  5692  3816 S  0.0  0.3  0:00.00 nginx: worker p
```

Lugner:

```
CPU[||                       2.1%]   Tasks: 10, 0 thr; 1 running
Mem[||||||||||||||||||||607M/1.92G]   Load average: 0.17 0.12 0.11
Swp[|                  268K/2.00G]   Uptime: 01:19:35

  PID USER       PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 7526 www-data    20   0 63224  7864  4772 S  0.7  0.4  0:00.65 nginx: worker p
 7092 www-data    20   0  189M 10532  6868 S  0.7  0.5  0:00.22 php-fpm: pool w
 7996 root        20   0  4788  3196  2768 R  0.0  0.2  0:00.22 htop
 7089 root        20   0  188M  6596  3216 S  0.0  0.3  0:00.15 php-fpm: master
 7091 www-data    20   0  189M  9924  6348 S  0.0  0.5  0:00.21 php-fpm: pool w
    1 root        20   0  4000  3216  2724 S  0.0  0.2  0:00.02 bash
   81 root        20   0  2456   128    80 S  0.0  0.0  0:00.00 /tmp/gns3/bin/u
   88 root        20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   94 root        20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 7523 root        20   0 61592  1740    52 S  0.0  0.1  0:00.00 nginx: master p
```

Revolte:

```
 98%      5
 99%      6
100%      6 (longest request)
root@Revolte:~/jawaban#
```

Linie:

```
CPU[||                       2.1%]   Tasks: 10, 0 thr; 1 running
Mem[||||||||||||||||||||607M/1.92G]   Load average: 0.17 0.12 0.11
Swp[|                  268K/2.00G]   Uptime: 01:19:35

  PID USER       PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 8022 root        20   0  4788  3124  2688 R  0.0  0.2  0:00.18 htop
 7088 root        20   0  188M  6536  3156 S  0.0  0.3  0:00.16 php-fpm: master
    1 root        20   0  3996  3324  2836 S  0.0  0.2  0:00.01 bash
   80 root        20   0  2456   128    80 S  0.0  0.0  0:00.00 /tmp/gns3/bin/u
   83 root        20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   92 root        20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 7090 www-data    20   0  189M  9928  6352 S  0.0  0.5  0:00.00 php-fpm: pool w
 7091 www-data    20   0  189M 10576  6912 S  0.0  0.5  0:00.00 php-fpm: pool w
 7518 root        20   0 61592  1736    52 S  0.0  0.1  0:00.00 nginx: master p
 7520 www-data    20   0 62228  5684  3776 S  0.0  0.3  0:00.00 nginx: worker p
```

Lawine:

```
CPU[||                       2.1%]   Tasks: 10, 0 thr; 1 running
Mem[||||||||||||||||||||607M/1.92G]   Load average: 0.17 0.12 0.11
Swp[|                  268K/2.00G]   Uptime: 01:19:35

  PID USER       PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 8151 root        20   0  4788  3184  2744 R  0.0  0.2  0:00.19 htop
 7089 root        20   0  188M  6744  3364 S  0.0  0.3  0:00.16 php-fpm: master
    1 root        20   0  4000  3260  2772 S  0.0  0.2  0:00.02 bash
   58 root        20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   64 root        20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   88 root        20   0  2456   128    80 S  0.0  0.0  0:00.00 /tmp/gns3/bin/u
 7091 www-data    20   0  189M  9860  6296 S  0.0  0.5  0:00.00 php-fpm: pool w
 7092 www-data    20   0  189M 10676  7012 S  0.0  0.5  0:00.00 php-fpm: pool w
 7707 root        20   0 61592  1748    64 S  0.0  0.1  0:00.00 nginx: master p
 7709 www-data    20   0 62228  5716  3816 S  0.0  0.3  0:00.00 nginx: worker p
```

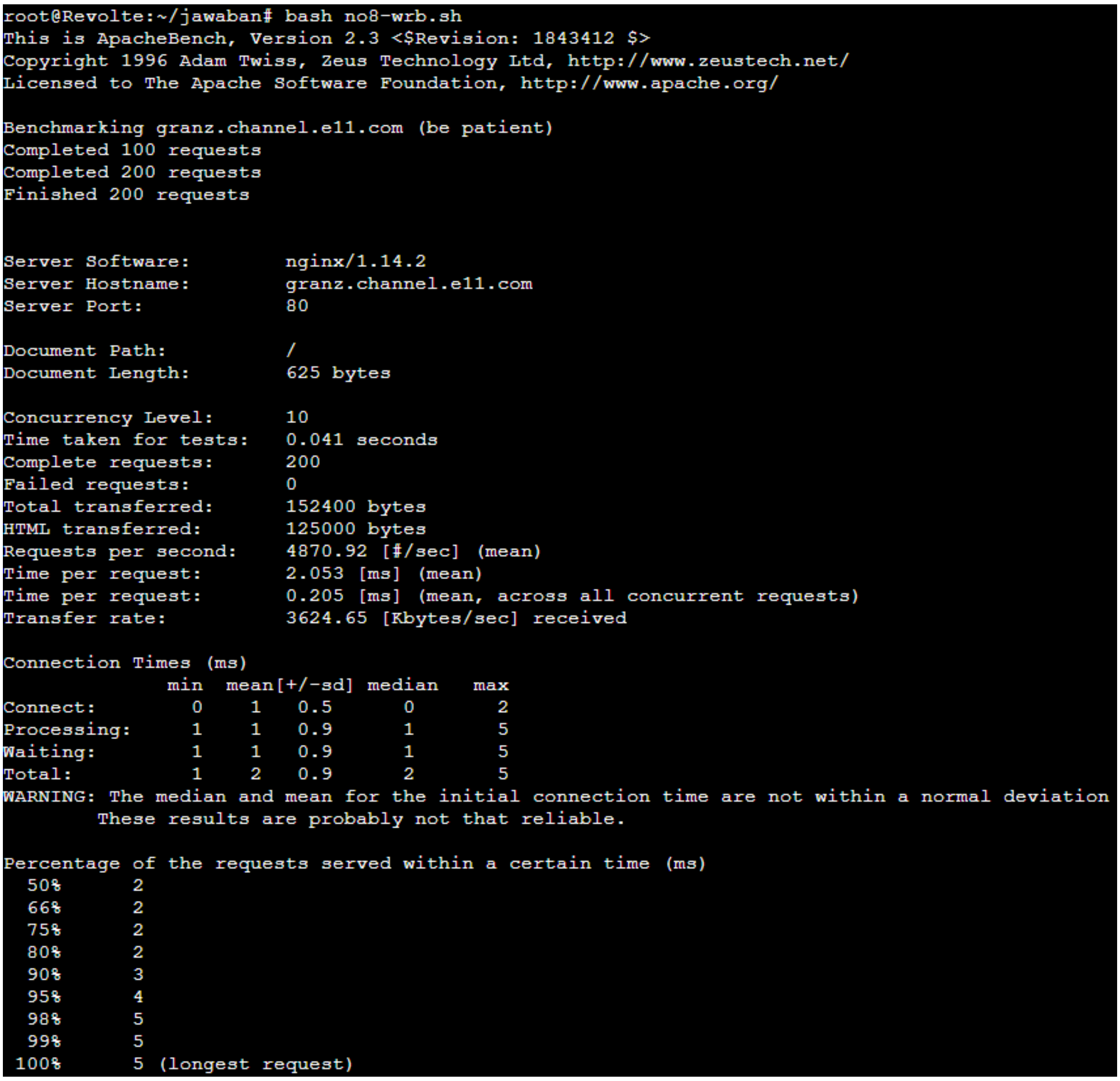
b. Analisis

waktu testing: 0.042s
complete request: 200
request per second: 4754.66
time per request: 2.103 ms

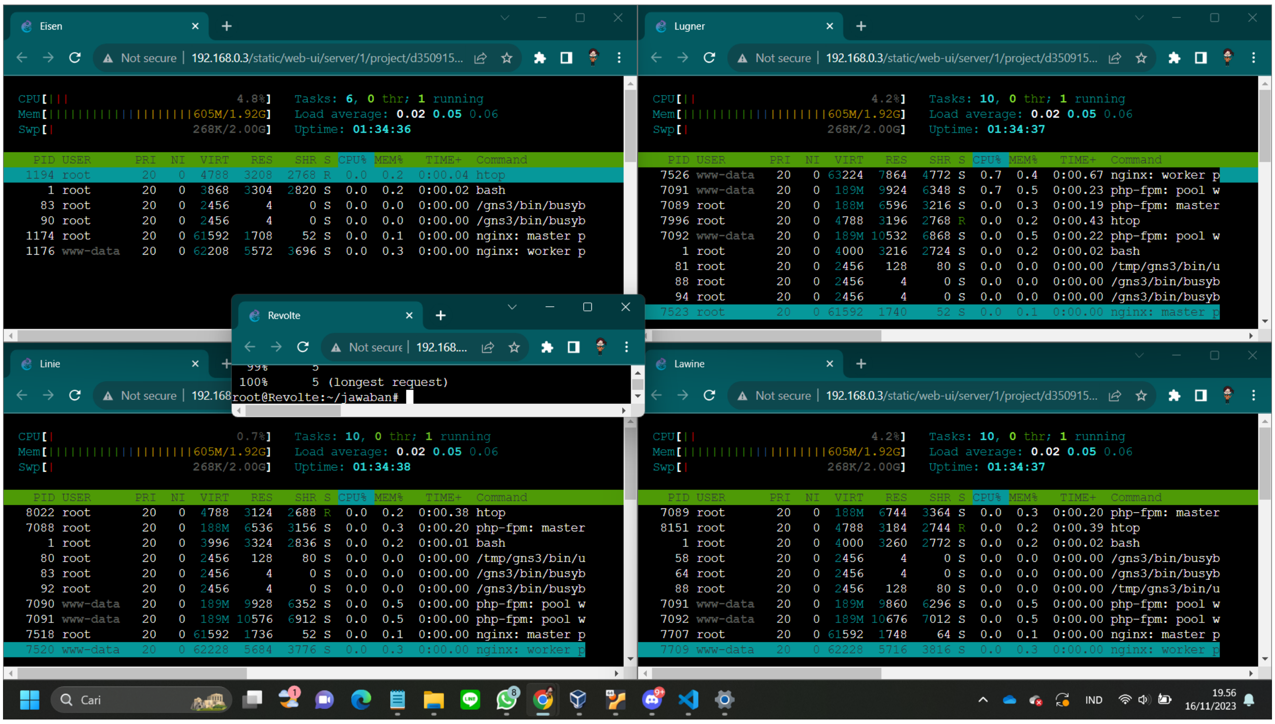
Berdasarkan hasil testing dengan 200 request dan 10 request/second menggunakan algoritma round robin(default), dapat dilihat bahwa ketiga worker tidak memiliki masalah ketika menerima request karena request yang diminta juga tidak terlalu banyak sehingga tidak terlalu terlihat dampaknya. Tidak ada request yang failed dan testing selesai dengan cepat hanya dalam waktu 0.042s.

2. Weighted Round Robin

a. Report hasil testing pada Apache Benchmark



```
root@Revolte:~/jawaban# bash no8-wrb.sh
This is ApacheBench, Version 2.3 <$Revision: 1843412 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking granz.channel.e11.com (be patient)
Completed 100 requests
Completed 200 requests
Finished 200 requests


Server Software:        nginx/1.14.2
Server Hostname:        granz.channel.e11.com
Server Port:            80

Document Path:          /
Document Length:        625 bytes

Concurrency Level:      10
Time taken for tests:   0.041 seconds
Complete requests:      200
Failed requests:        0
Total transferred:      152400 bytes
HTML transferred:       125000 bytes
Requests per second:    4870.92 [#/sec] (mean)
Time per request:       2.053 [ms] (mean)
Time per request:       0.205 [ms] (mean, across all concurrent requests)
Transfer rate:          3624.65 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    1   0.5      0       2
Processing:     1    1   0.9      1       5
Waiting:        1    1   0.9      1       5
Total:          1    2   0.9      2       5
WARNING: The median and mean for the initial connection time are not within a normal deviation
        These results are probably not that reliable.

Percentage of the requests served within a certain time (ms)
  50%      2
  66%      2
  75%      2
  80%      2
  90%      3
  95%      4
  98%      5
  99%      5
 100%      5 (longest request)
```



Eisen
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...

```
CPU[|||                         4.8%]   Tasks: 6, 0 thr; 1 running
Mem[|||||||||||||||||||||605M/1.92G]   Load average: 0.02 0.05 0.06
Swp[|                      268K/2.00G]   Uptime: 01:34:36

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 1194 root       20   0  4788  3208  2768 R  0.0  0.2  0:00.04 htop
    1 root       20   0  3868  3304  2820 S  0.0  0.2  0:00.02 bash
   83 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   90 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 1174 root       20   0 61592  1708    52 S  0.0  0.1  0:00.00 nginx: master p
 1176 www-data   20   0 62208  5572  3696 S  0.0  0.3  0:00.00 nginx: worker p
```

Lugner
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...

```
CPU[||                          4.2%]   Tasks: 10, 0 thr; 1 running
Mem[|||||||||||||||||||||605M/1.92G]   Load average: 0.02 0.05 0.06
Swp[|                      268K/2.00G]   Uptime: 01:34:37

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 7526 www-data   20   0 63224  7864  4772 S  0.7  0.4  0:00.67 nginx: worker p
 7091 www-data   20   0  189M  9924  6348 S  0.7  0.5  0:00.23 php-fpm: pool w
 7089 root       20   0  188M  6596  3216 S  0.0  0.3  0:00.19 php-fpm: master
 7996 root       20   0  4788  3196  2768 R  0.0  0.2  0:00.43 htop
 7092 www-data   20   0  189M 10532  6868 S  0.0  0.5  0:00.22 php-fpm: pool w
    1 root       20   0  4000  3216  2724 S  0.0  0.2  0:00.02 bash
   81 root       20   0  2456   128    80 S  0.0  0.0  0:00.00 /tmp/gns3/bin/u
   88 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   94 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 7523 root       20   0 61592  1740    52 S  0.0  0.1  0:00.00 nginx: master p
```

```
 99%      5
100%      5 (longest request)
root@Revolte:~/jawaban# 
```

```
CPU[|                           0.7%]   Tasks: 10, 0 thr; 1 running
Mem[|||||||||||||||||||||605M/1.92G]   Load average: 0.02 0.05 0.06
Swp[|                      268K/2.00G]   Uptime: 01:34:38

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 8022 root       20   0  4788  3124  2688 R  0.0  0.2  0:00.38 htop
 7088 root       20   0  188M  6536  3156 S  0.0  0.3  0:00.20 php-fpm: master
    1 root       20   0  3996  3324  2836 S  0.0  0.2  0:00.01 bash
   80 root       20   0  2456   128    80 S  0.0  0.0  0:00.00 /tmp/gns3/bin/u
   83 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   92 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 7090 www-data   20   0  189M  9928  6352 S  0.0  0.5  0:00.00 php-fpm: pool w
 7091 www-data   20   0  189M 10576  6912 S  0.0  0.5  0:00.00 php-fpm: pool w
 7518 root       20   0 61592  1736    52 S  0.0  0.1  0:00.00 nginx: master p
 7520 www-data   20   0 62228  5684  3776 S  0.0  0.3  0:00.00 nginx: worker p
```

Lawine
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...

```
CPU[||                          4.2%]   Tasks: 10, 0 thr; 1 running
Mem[|||||||||||||||||||||605M/1.92G]   Load average: 0.02 0.05 0.06
Swp[|                      268K/2.00G]   Uptime: 01:34:37

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 7089 root       20   0  188M  6744  3364 S  0.0  0.3  0:00.20 php-fpm: master
 8151 root       20   0  4788  3184  2744 R  0.0  0.2  0:00.39 htop
    1 root       20   0  4000  3260  2772 S  0.0  0.2  0:00.02 bash
   58 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   64 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   88 root       20   0  2456   128    80 S  0.0  0.0  0:00.00 /tmp/gns3/bin/u
 7091 www-data   20   0  189M  9860  6296 S  0.0  0.5  0:00.00 php-fpm: pool w
 7092 www-data   20   0  189M 10676  7012 S  0.0  0.5  0:00.00 php-fpm: pool w
 7707 root       20   0 61592  1748    64 S  0.0  0.1  0:00.00 nginx: master p
 7709 www-data   20   0 62228  5716  3816 S  0.0  0.3  0:00.00 nginx: worker p
```

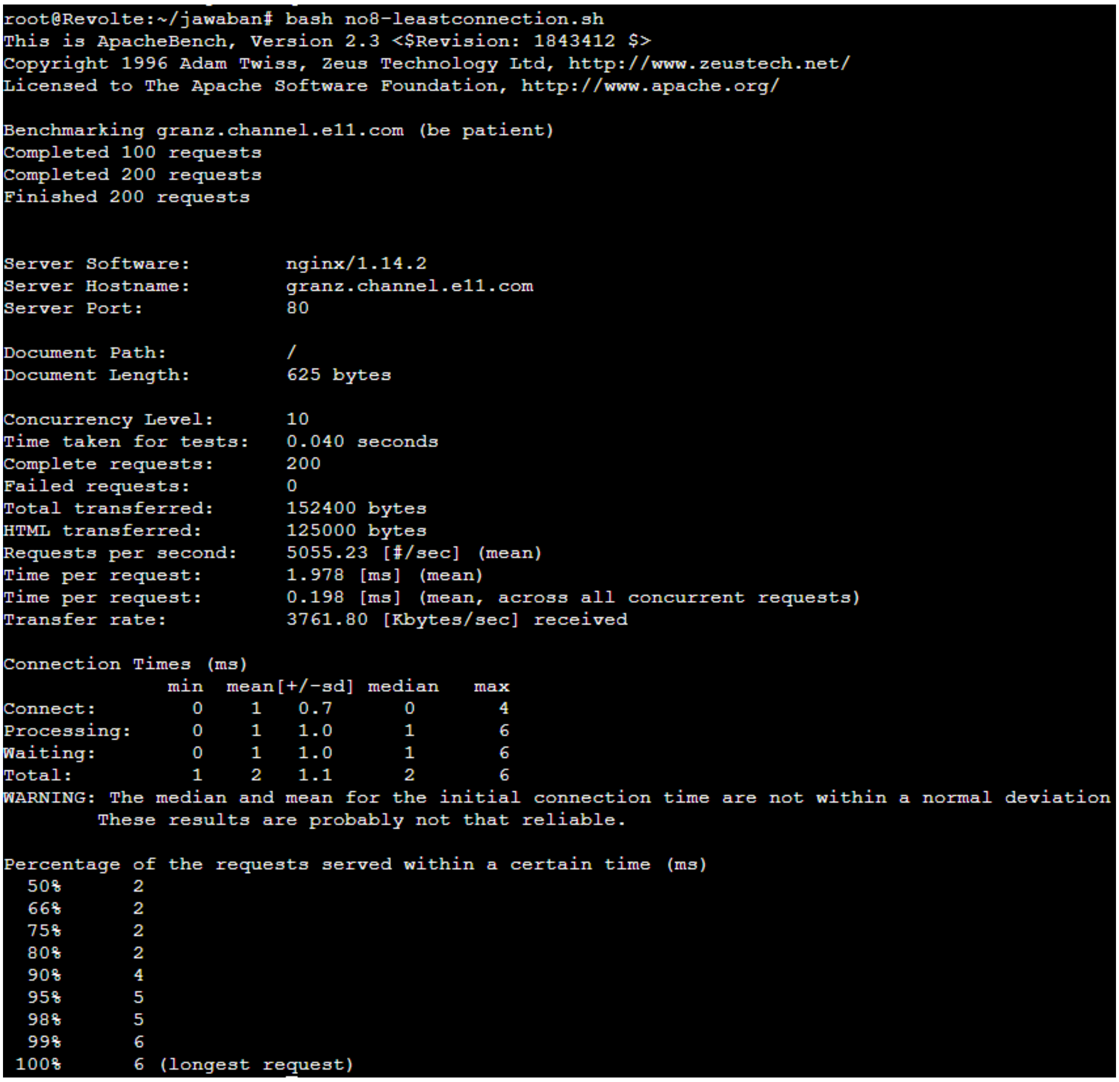
b. **Analisis**

waktu testing: 0.041s
complete request: 200
request per second: 4870.92
time per request: 2.053 ms

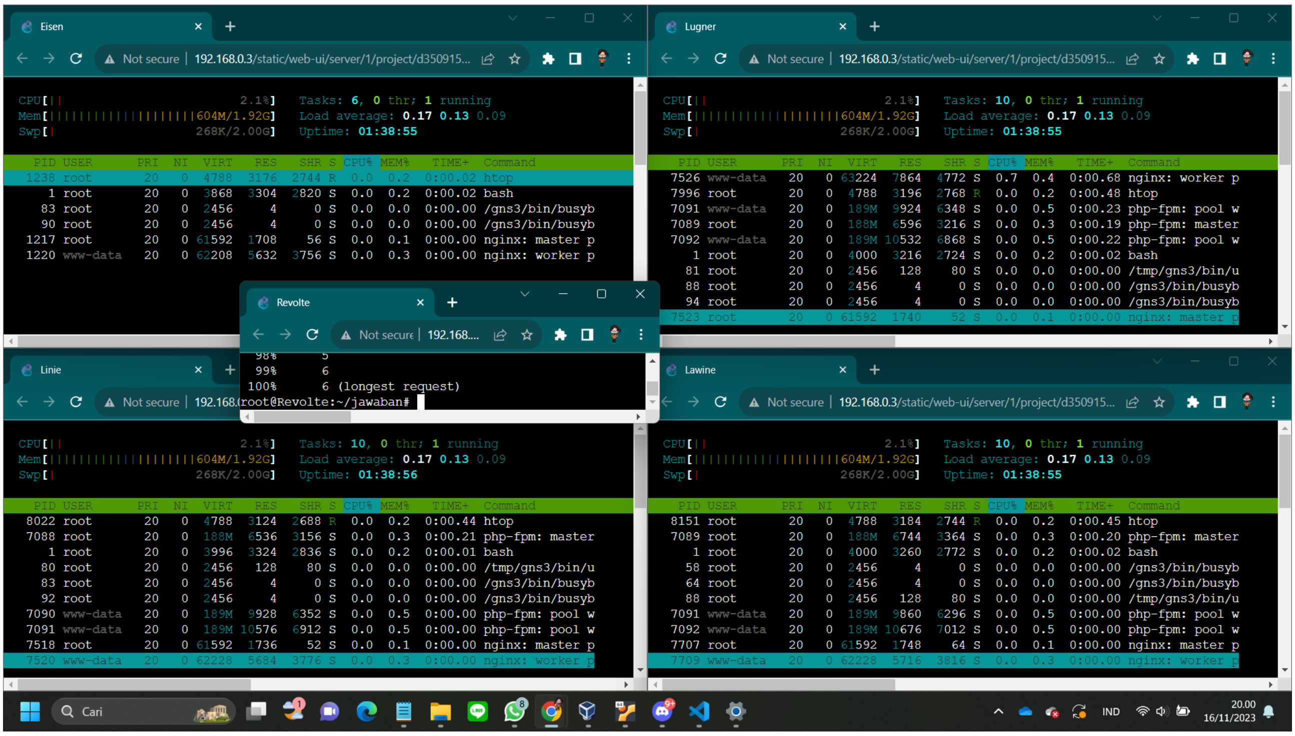
Berdasarkan hasil testing dengan 200 request dan 10 request/second menggunakan algoritma weighted round robin, yaitu algoritma yang menetapkan beban pada masing-masing server dan menjadikan server yang memiliki weight tertinggi sebagai prioritas, dalam kasus ini yaitu Lugner, dapat dilihat bahwa request sebagian besar diterima oleh Lugner. Ketiga worker juga tidak memiliki masalah ketika menerima request karena request yang diminta juga tidak terlalu banyak sehingga tidak terlalu terlihat dampaknya. Tidak ada request yang failed dan testing selesai dengan cepat hanya dalam waktu 0.041s, 0.001 detik lebih cepat dibanding default round robin. Algoritma ini juga mampu menerima request/detik lebih banyak dibanding algoritma default round robin.

3. Least Connection

a. Report hasil testing pada Apache Benchmark



```
root@Revolte:~/jawaban# bash no8-leastconnection.sh
This is ApacheBench, Version 2.3 <$Revision: 1843412 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking granz.channel.e11.com (be patient)
Completed 100 requests
Completed 200 requests
Finished 200 requests


Server Software:        nginx/1.14.2
Server Hostname:        granz.channel.e11.com
Server Port:            80

Document Path:          /
Document Length:        625 bytes

Concurrency Level:      10
Time taken for tests:   0.040 seconds
Complete requests:      200
Failed requests:        0
Total transferred:      152400 bytes
HTML transferred:       125000 bytes
Requests per second:    5055.23 [#/sec] (mean)
Time per request:       1.978 [ms] (mean)
Time per request:       0.198 [ms] (mean, across all concurrent requests)
Transfer rate:          3761.80 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    1   0.7      0       4
Processing:     0    1   1.0      1       6
Waiting:        0    1   1.0      1       6
Total:          1    2   1.1      2       6
WARNING: The median and mean for the initial connection time are not within a normal deviation
        These results are probably not that reliable.

Percentage of the requests served within a certain time (ms)
  50%      2
  66%      2
  75%      2
  80%      2
  90%      4
  95%      5
  98%      5
  99%      6
 100%      6 (longest request)
```


Eisen
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...
Lugner
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...
Revolte
Not secure | 192.168....
Linie
Not secure | 192.168.
Lawine
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...
Cari
IND
20.00
16/11/2023

```
CPU[||                      2.1%]   Tasks: 6, 0 thr; 1 running
Mem[|||||||||||||||||||604M/1.92G]   Load average: 0.17 0.13 0.09
Swp[|                  268K/2.00G]   Uptime: 01:38:55

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 1238 root       20   0  4788  3176  2744 R  0.0  0.2  0:00.02 htop
    1 root       20   0  3868  3304  2820 S  0.0  0.2  0:00.02 bash
   83 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   90 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 1217 root       20   0 61592  1708    56 S  0.0  0.1  0:00.00 nginx: master p
 1220 www-data   20   0 62208  5632  3756 S  0.0  0.3  0:00.00 nginx: worker p
```

```
CPU[||                      2.1%]   Tasks: 10, 0 thr; 1 running
Mem[|||||||||||||||||||604M/1.92G]   Load average: 0.17 0.13 0.09
Swp[|                  268K/2.00G]   Uptime: 01:38:55

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 7526 www-data   20   0 63224  7864  4772 S  0.7  0.4  0:00.68 nginx: worker p
 7996 root       20   0  4788  3196  2768 R  0.0  0.2  0:00.48 htop
 7091 www-data   20   0  189M  9924  6348 S  0.0  0.5  0:00.23 php-fpm: pool w
 7089 root       20   0  188M  6596  3216 S  0.0  0.3  0:00.19 php-fpm: master
 7092 www-data   20   0  189M 10532  6868 S  0.0  0.5  0:00.22 php-fpm: pool w
    1 root       20   0  4000  3216  2724 S  0.0  0.2  0:00.02 bash
   81 root       20   0  2456   128    80 S  0.0  0.0  0:00.00 /tmp/gns3/bin/u
   88 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   94 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 7523 root       20   0 61592  1740    52 S  0.0  0.1  0:00.00 nginx: master p
```

```
 98%      5
 99%      6
100%      6 (longest request)
root@Revolte:~/jawaban#
```

```
CPU[||                      2.1%]   Tasks: 10, 0 thr; 1 running
Mem[|||||||||||||||||||604M/1.92G]   Load average: 0.17 0.13 0.09
Swp[|                  268K/2.00G]   Uptime: 01:38:56

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 8022 root       20   0  4788  3124  2688 R  0.0  0.2  0:00.44 htop
 7088 root       20   0  188M  6536  3156 S  0.0  0.3  0:00.21 php-fpm: master
    1 root       20   0  3996  3324  2836 S  0.0  0.2  0:00.01 bash
   80 root       20   0  2456   128    80 S  0.0  0.0  0:00.00 /tmp/gns3/bin/u
   83 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   92 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 7090 www-data   20   0  189M  9928  6352 S  0.0  0.5  0:00.00 php-fpm: pool w
 7091 www-data   20   0  189M 10576  6912 S  0.0  0.5  0:00.00 php-fpm: pool w
 7518 root       20   0 61592  1736    52 S  0.0  0.1  0:00.00 nginx: master p
 7520 www-data   20   0 62228  5684  3776 S  0.0  0.3  0:00.00 nginx: worker p
```

```
CPU[||                      2.1%]   Tasks: 10, 0 thr; 1 running
Mem[|||||||||||||||||||604M/1.92G]   Load average: 0.17 0.13 0.09
Swp[|                  268K/2.00G]   Uptime: 01:38:55

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 8151 root       20   0  4788  3184  2744 R  0.0  0.2  0:00.45 htop
 7089 root       20   0  188M  6744  3364 S  0.0  0.3  0:00.20 php-fpm: master
    1 root       20   0  4000  3260  2772 S  0.0  0.2  0:00.02 bash
   58 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   64 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   88 root       20   0  2456   128    80 S  0.0  0.0  0:00.00 /tmp/gns3/bin/u
 7091 www-data   20   0  189M  9860  6296 S  0.0  0.5  0:00.00 php-fpm: pool w
 7092 www-data   20   0  189M 10676  7012 S  0.0  0.5  0:00.00 php-fpm: pool w
 7707 root       20   0 61592  1748    64 S  0.0  0.1  0:00.00 nginx: master p
 7709 www-data   20   0 62228  5716  3816 S  0.0  0.3  0:00.00 nginx: worker p
```

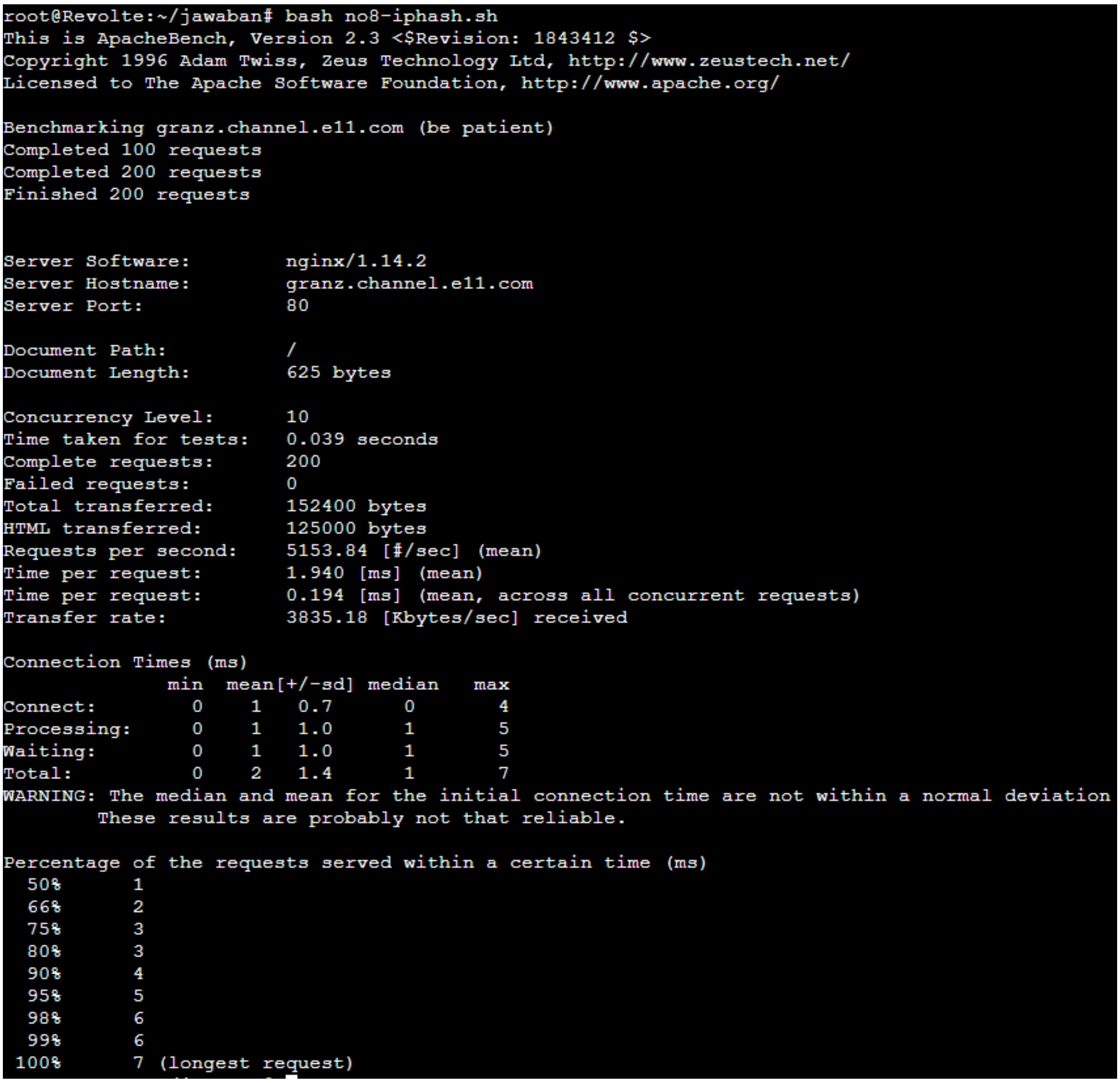
b. Analisis

waktu testing: 0.040s
complete request: 200
request per second: 5055.23
time per request: 1.978 ms

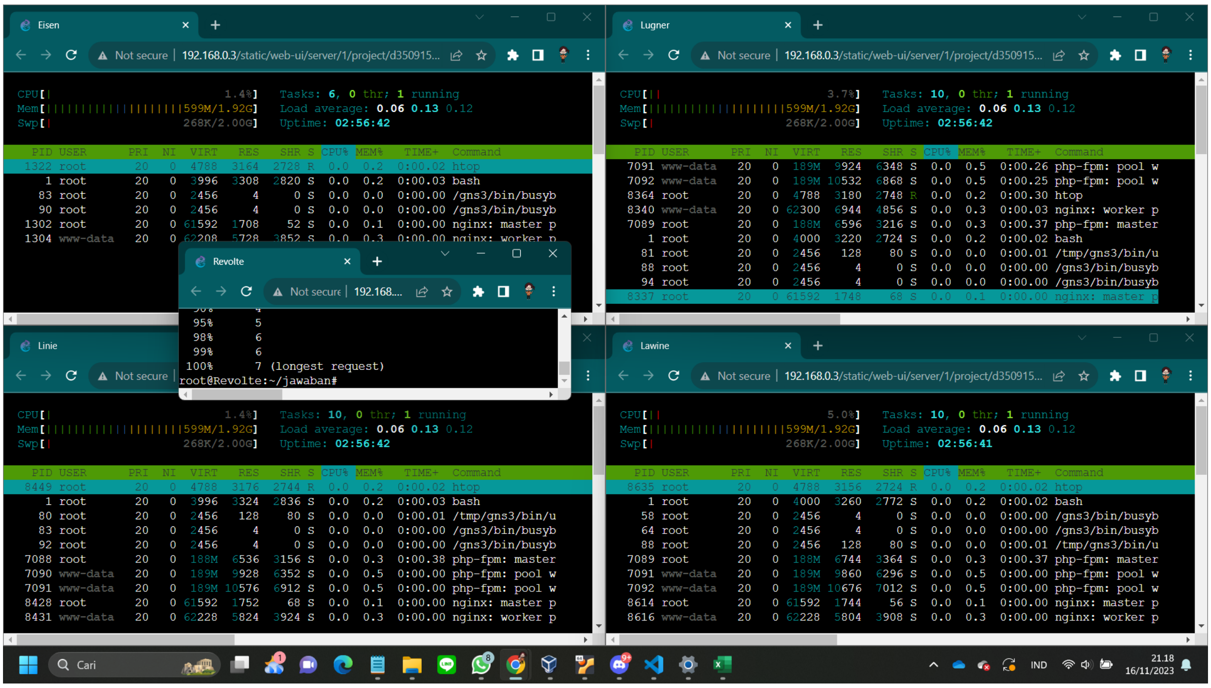
Berdasarkan hasil testing dengan 200 request dan 10 request/second menggunakan algoritma weighted round robin, yaitu algoritma yang akan melakukan prioritas dari beban kinerja yang paling rendah. Jika dilihat dari grafik htop, tidak terlalu nampak perbedaan antara ketiga worker karena untuk kasus ini request yang diberikan juga tidak terlalu banyak. Ketiga worker juga tidak memiliki masalah ketika menerima request karena request yang diminta juga tidak terlalu banyak sehingga tidak terlalu terlihat dampaknya. Tidak ada request yang failed dan testing selesai dengan cepat hanya dalam waktu 0.040s, 0.002 detik lebih cepat dibanding default round robin, dan 0.001 detik lebih cepat dibanding weighted round robin. Algoritma ini juga mampu menerima request/detik lebih banyak dibanding algoritma default round robin dan weighted round robin.

4. IP Hash

a. Report hasil testing pada Apache Benchmark



```
root@Revolte:~/jawaban# bash no8-iphash.sh
This is ApacheBench, Version 2.3 <$Revision: 1843412 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking granz.channel.e11.com (be patient)
Completed 100 requests
Completed 200 requests
Finished 200 requests


Server Software:        nginx/1.14.2
Server Hostname:        granz.channel.e11.com
Server Port:            80

Document Path:          /
Document Length:        625 bytes

Concurrency Level:      10
Time taken for tests:   0.039 seconds
Complete requests:      200
Failed requests:        0
Total transferred:      152400 bytes
HTML transferred:       125000 bytes
Requests per second:    5153.84 [#/sec] (mean)
Time per request:       1.940 [ms] (mean)
Time per request:       0.194 [ms] (mean, across all concurrent requests)
Transfer rate:          3835.18 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    1   0.7      0       4
Processing:     0    1   1.0      1       5
Waiting:        0    1   1.0      1       5
Total:          0    2   1.4      1       7
WARNING: The median and mean for the initial connection time are not within a normal deviation
        These results are probably not that reliable.

Percentage of the requests served within a certain time (ms)
  50%      1
  66%      2
  75%      3
  80%      3
  90%      4
  95%      5
  98%      6
  99%      6
 100%      7 (longest request)
```



```
CPU[|                    1.4%]   Tasks: 6, 0 thr; 1 running
Mem[||||||||||||||||||||599M/1.92G]   Load average: 0.06 0.13 0.12
Swp[|                268K/2.00G]   Uptime: 02:56:42

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 1322 root       20   0  4788  3164  2728 R  0.0  0.2  0:00.02 htop
    1 root       20   0  3996  3308  2820 S  0.0  0.2  0:00.03 bash
   83 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   90 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 1302 root       20   0 61592  1708    52 S  0.0  0.1  0:00.00 nginx: master p
 1304 www-data   20   0 62208  5728  3852 S  0.0  0.3  0:00.00 nginx: worker p
```

```
CPU[||                   3.7%]   Tasks: 10, 0 thr; 1 running
Mem[||||||||||||||||||||599M/1.92G]   Load average: 0.06 0.13 0.12
Swp[|                268K/2.00G]   Uptime: 02:56:42

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 7091 www-data   20   0  189M  9924  6348 S  0.0  0.5  0:00.26 php-fpm: pool w
 7092 www-data   20   0  189M 10532  6868 S  0.0  0.5  0:00.25 php-fpm: pool w
 8364 root       20   0  4788  3180  2748 R  0.0  0.2  0:00.30 htop
 8340 www-data   20   0 62300  6944  4856 S  0.0  0.3  0:00.03 nginx: worker p
 7089 root       20   0  188M  6596  3216 S  0.0  0.3  0:00.37 php-fpm: master
    1 root       20   0  4000  3220  2724 S  0.0  0.2  0:00.02 bash
   81 root       20   0  2456   128    80 S  0.0  0.0  0:00.01 /tmp/gns3/bin/u
   88 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   94 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 8337 root       20   0 61592  1748    68 S  0.0  0.1  0:00.00 nginx: master p
```

```
  95%      5
  98%      6
  99%      6
 100%      7 (longest request)
root@Revolte:~/jawaban#
```

```
CPU[|                    1.4%]   Tasks: 10, 0 thr; 1 running
Mem[||||||||||||||||||||599M/1.92G]   Load average: 0.06 0.13 0.12
Swp[|                268K/2.00G]   Uptime: 02:56:42

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 8449 root       20   0  4788  3176  2744 R  0.0  0.2  0:00.02 htop
    1 root       20   0  3996  3324  2836 S  0.0  0.2  0:00.03 bash
   80 root       20   0  2456   128    80 S  0.0  0.0  0:00.01 /tmp/gns3/bin/u
   83 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   92 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 7088 root       20   0  188M  6536  3156 S  0.0  0.3  0:00.38 php-fpm: master
 7090 www-data   20   0  189M  9928  6352 S  0.0  0.5  0:00.00 php-fpm: pool w
 7091 www-data   20   0  189M 10576  6912 S  0.0  0.5  0:00.00 php-fpm: pool w
 8428 root       20   0 61592  1752    68 S  0.0  0.1  0:00.00 nginx: master p
 8431 www-data   20   0 62228  5824  3924 S  0.0  0.3  0:00.00 nginx: worker p
```

```
CPU[||                   5.0%]   Tasks: 10, 0 thr; 1 running
Mem[||||||||||||||||||||599M/1.92G]   Load average: 0.06 0.13 0.12
Swp[|                268K/2.00G]   Uptime: 02:56:41

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 8635 root       20   0  4788  3156  2724 R  0.0  0.2  0:00.02 htop
    1 root       20   0  4000  3260  2772 S  0.0  0.2  0:00.02 bash
   58 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   64 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   88 root       20   0  2456   128    80 S  0.0  0.0  0:00.01 /tmp/gns3/bin/u
 7089 root       20   0  188M  6744  3364 S  0.0  0.3  0:00.37 php-fpm: master
 7091 www-data   20   0  189M  9860  6296 S  0.0  0.5  0:00.00 php-fpm: pool w
 7092 www-data   20   0  189M 10676  7012 S  0.0  0.5  0:00.00 php-fpm: pool w
 8614 root       20   0 61592  1744    56 S  0.0  0.1  0:00.00 nginx: master p
 8616 www-data   20   0 62228  5804  3908 S  0.0  0.3  0:00.00 nginx: worker p
```

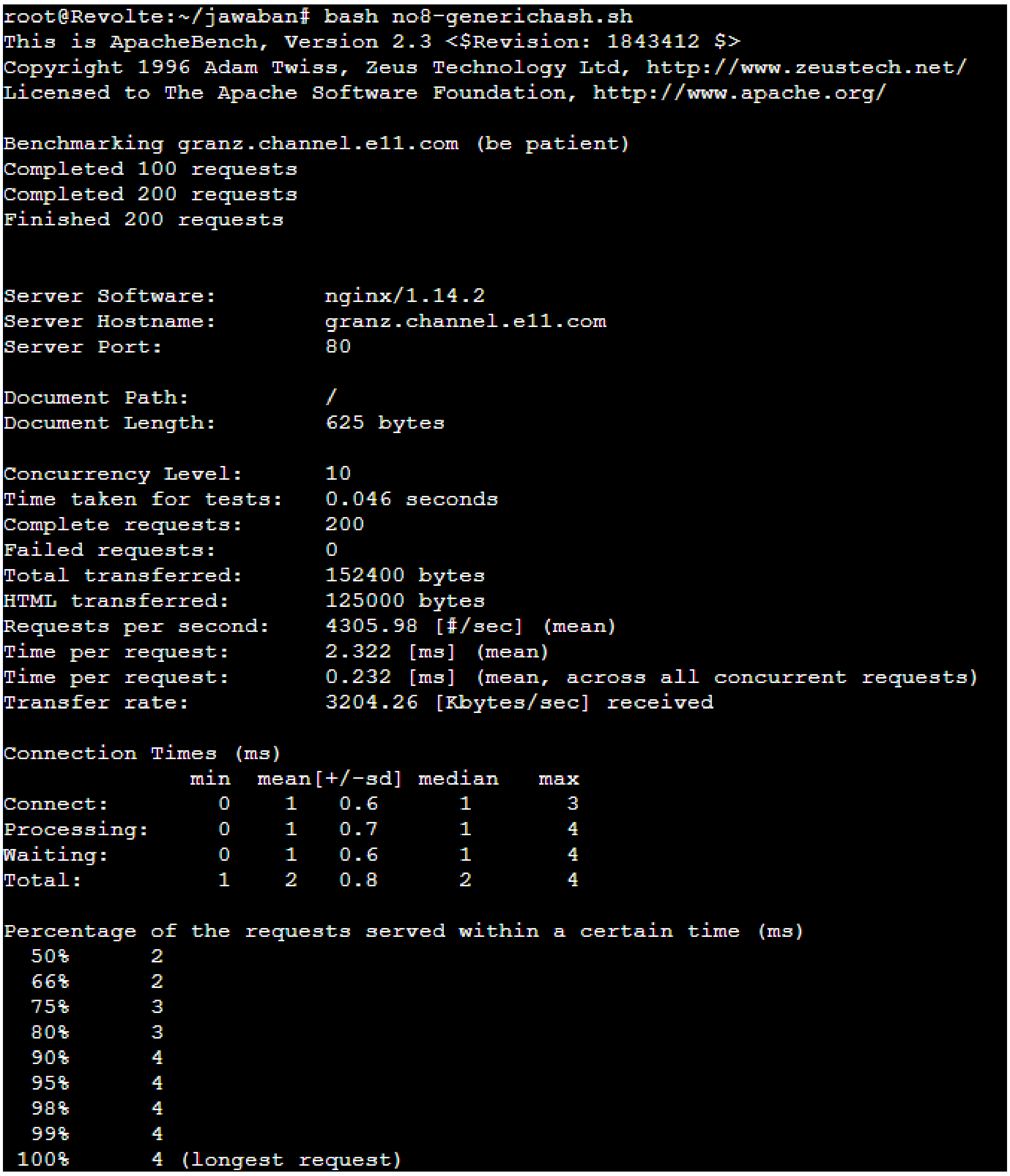
b. **Analisis**

waktu testing: 0.039s
complete request: 200
request per second: 5153.84
time per request: 1.940 ms

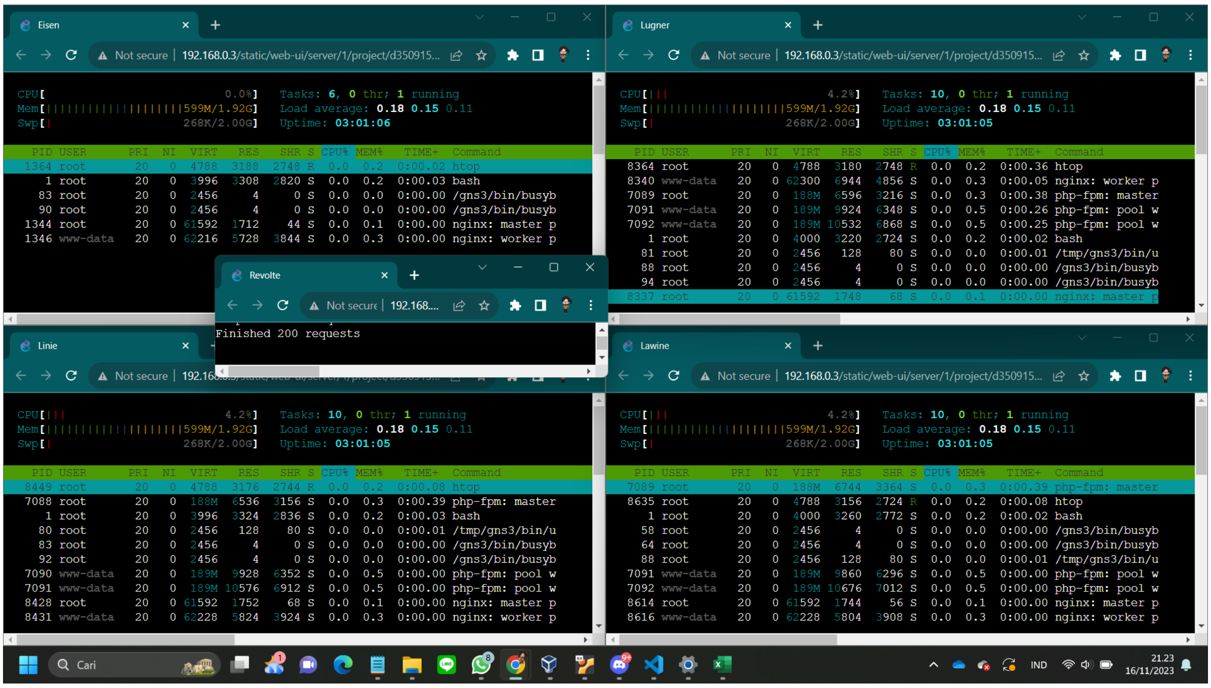
Berdasarkan hasil testing dengan 200 request dan 10 request/second menggunakan algoritma IP Hash, yaitu algoritma yang akan mendistribusikan request berdasarkan IP address dari client. Ini berarti bahwa setiap client dengan IP tertentu akan terus terhubung ke worker yang sama untuk setiap requestnya. Jika dilihat dari grafik htop, kita dapat melihat bahwa tidak ada satu worker pun yang terlihat kelebihan beban (overloaded). CPU dan penggunaan memori terdistribusi secara merata dan tidak ada peningkatan yang signifikan selama periode pengujian, yang menunjukkan bahwa beban ditangani dengan baik oleh server. Reaksi worker tampak konsisten terhadap beban yang diberikan. Tidak ada peningkatan yang mendadak atau penurunan dalam penggunaan sumber daya, yang menunjukkan bahwa konfigurasi IP hash berhasil mendistribusikan beban tanpa menyebabkan isu pada worker tertentu. Hasil testing menunjukkan bahwa semua request berhasil dilayani tanpa gagal. Waktu yang diperlukan untuk menyelesaikan semua request sangat cepat, hanya 0.039 detik, dengan rata-rata waktu per request pada tingkat konkurensi yang tinggi hanya 1.940 ms, yang merupakan performa yang sangat baik. Konfigurasi server dengan algoritma IP hash berjalan efisien dan stabil untuk jumlah request tersebut. Server mampu menangani beban dengan distribusi yang merata antara worker, dan tidak ada indikasi masalah performa atau kestabilan.

5. **Generic Hash**

a. Report hasil testing pada Apache Benchmark



```
root@Revolte:~/jawaban# bash no8-generichash.sh
This is ApacheBench, Version 2.3 <$Revision: 1843412 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking granz.channel.e11.com (be patient)
Completed 100 requests
Completed 200 requests
Finished 200 requests


Server Software:        nginx/1.14.2
Server Hostname:        granz.channel.e11.com
Server Port:            80

Document Path:          /
Document Length:        625 bytes

Concurrency Level:      10
Time taken for tests:   0.046 seconds
Complete requests:      200
Failed requests:        0
Total transferred:      152400 bytes
HTML transferred:       125000 bytes
Requests per second:    4305.98 [#/sec] (mean)
Time per request:       2.322 [ms] (mean)
Time per request:       0.232 [ms] (mean, across all concurrent requests)
Transfer rate:          3204.26 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    1   0.6      1       3
Processing:     0    1   0.7      1       4
Waiting:        0    1   0.6      1       4
Total:          1    2   0.8      2       4

Percentage of the requests served within a certain time (ms)
  50%      2
  66%      2
  75%      3
  80%      3
  90%      4
  95%      4
  98%      4
  99%      4
 100%      4 (longest request)
```



```
CPU[                          0.0%]   Tasks: 6, 0 thr; 1 running
Mem[||||||||||||||||||||599M/1.92G]   Load average: 0.18 0.15 0.11
Swp[|                  268K/2.00G]   Uptime: 03:01:06

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 1364 root       20   0  4788  3188  2748 R  0.0  0.2  0:00.02 htop
    1 root       20   0  3996  3308  2820 S  0.0  0.2  0:00.03 bash
   83 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   90 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 1344 root       20   0 61592  1712    44 S  0.0  0.1  0:00.00 nginx: master p
 1346 www-data   20   0 62216  5728  3844 S  0.0  0.3  0:00.00 nginx: worker p
```

```
CPU[|||                       4.2%]   Tasks: 10, 0 thr; 1 running
Mem[||||||||||||||||||||599M/1.92G]   Load average: 0.18 0.15 0.11
Swp[|                  268K/2.00G]   Uptime: 03:01:05

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 8364 root       20   0  4788  3180  2748 R  0.0  0.2  0:00.36 htop
 8340 www-data   20   0 62300  6944  4856 S  0.0  0.3  0:00.05 nginx: worker p
 7089 root       20   0  188M  6596  3216 S  0.0  0.3  0:00.38 php-fpm: master
 7091 www-data   20   0  189M  9924  6348 S  0.0  0.5  0:00.26 php-fpm: pool w
 7092 www-data   20   0  189M 10532  6868 S  0.0  0.5  0:00.25 php-fpm: pool w
    1 root       20   0  4000  3220  2724 S  0.0  0.2  0:00.02 bash
   81 root       20   0  2456   128    80 S  0.0  0.0  0:00.01 /tmp/gns3/bin/u
   88 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   94 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 8337 root       20   0 61592  1748    68 S  0.0  0.1  0:00.00 nginx: master p
```

```
Finished 200 requests
```

```
CPU[|||                       4.2%]   Tasks: 10, 0 thr; 1 running
Mem[||||||||||||||||||||599M/1.92G]   Load average: 0.18 0.15 0.11
Swp[|                  268K/2.00G]   Uptime: 03:01:05

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 8449 root       20   0  4788  3176  2744 R  0.0  0.2  0:00.08 htop
 7088 root       20   0  188M  6536  3156 S  0.0  0.3  0:00.39 php-fpm: master
    1 root       20   0  3996  3324  2836 S  0.0  0.2  0:00.03 bash
   80 root       20   0  2456   128    80 S  0.0  0.0  0:00.01 /tmp/gns3/bin/u
   83 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   92 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 7090 www-data   20   0  189M  9928  6352 S  0.0  0.5  0:00.00 php-fpm: pool w
 7091 www-data   20   0  189M 10576  6912 S  0.0  0.5  0:00.00 php-fpm: pool w
 8428 root       20   0 61592  1752    68 S  0.0  0.1  0:00.00 nginx: master p
 8431 www-data   20   0 62228  5824  3924 S  0.0  0.3  0:00.00 nginx: worker p
```

```
CPU[|||                       4.2%]   Tasks: 10, 0 thr; 1 running
Mem[||||||||||||||||||||599M/1.92G]   Load average: 0.18 0.15 0.11
Swp[|                  268K/2.00G]   Uptime: 03:01:05

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 7089 root       20   0  188M  6744  3364 S  0.0  0.3  0:00.39 php-fpm: master
 8635 root       20   0  4788  3156  2724 R  0.0  0.2  0:00.08 htop
    1 root       20   0  4000  3260  2772 S  0.0  0.2  0:00.02 bash
   58 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   64 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   88 root       20   0  2456   128    80 S  0.0  0.0  0:00.01 /tmp/gns3/bin/u
 7091 www-data   20   0  189M  9860  6296 S  0.0  0.5  0:00.00 php-fpm: pool w
 7092 www-data   20   0  189M 10676  7012 S  0.0  0.5  0:00.00 php-fpm: pool w
 8614 root       20   0 61592  1744    56 S  0.0  0.1  0:00.00 nginx: master p
 8616 www-data   20   0 62228  5804  3908 S  0.0  0.3  0:00.00 nginx: worker p
```

b. Analisis

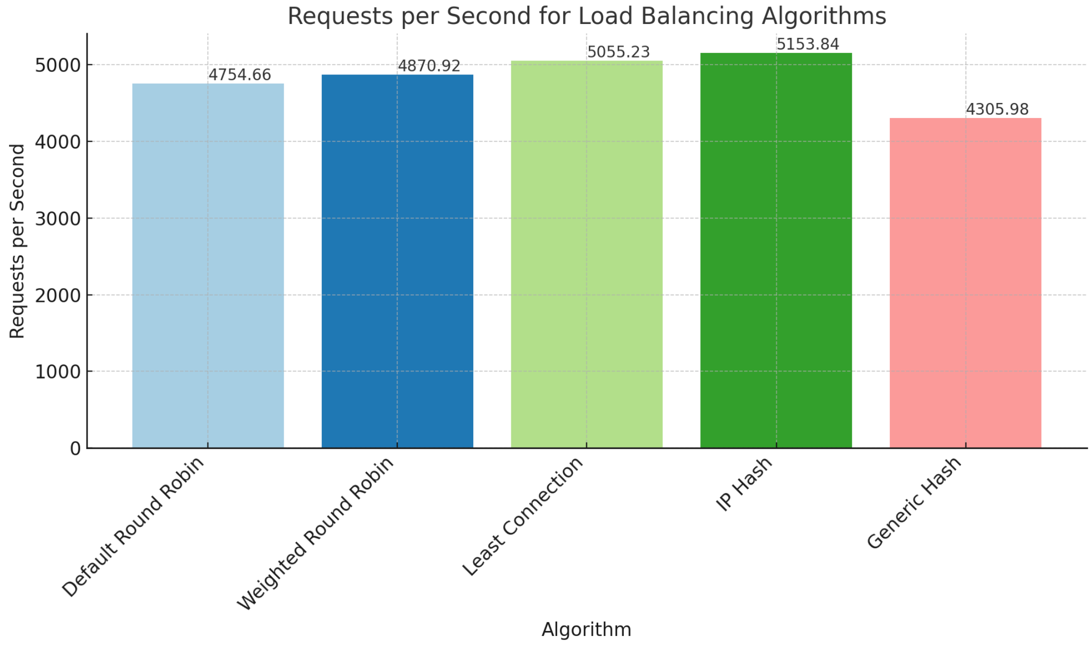
waktu testing: 0.046s
complete request: 200
request per second: 4305.98
time per request: 2.322 ms

Berdasarkan hasil testing dengan 200 request dan 10 request/second menggunakan algoritma Generic Hash, yaitu algoritma yang mendistribusikan beban berdasarkan hash dari beberapa atribut permintaan yang dapat menyebabkan distribusi yang lebih merata dibandingkan IP hash yang hanya mempertimbangkan alamat IP client. Jika dilihat dari grafik htop, terlihat bahwa beban CPU dan memori pada masing-masing worker tampak stabil dan tidak ada lonjakan yang signifikan selama proses benchmarking. Ini menunjukkan bahwa server mampu menangani beban yang dihasilkan oleh benchmarking tanpa kesulitan. Reaksi worker dalam grafik menunjukkan bahwa tidak ada satu worker pun yang mengalami stress berlebihan; tidak terlihat satu worker pun yang mendominasi proses atau menjadi bottleneck. Ini menunjukkan bahwa algoritma Generic hash berhasil mendistribusikan beban dengan baik. Hasil testing menunjukkan bahwa tidak ada request yang gagal, dan semua request selesai dalam waktu yang sangat singkat. Ini menandakan bahwa server dan algoritma hashing yang digunakan efektif dalam menangani banyak request dalam waktu yang singkat. Generic hash memberikan performa yang sangat baik dalam konteks konkurensi tinggi untuk jumlah request yang ditest. Server menunjukkan kinerja yang optimal dengan semua request dilayani tanpa kesalahan. Meskipun waktu per request sedikit lebih tinggi dibandingkan dengan hasil testing algoritma weighted round robin, perbedaannya tidak signifikan dan tidak mempengaruhi keseluruhan kinerja server.

6. Kesimpulan

Algoritma	Waktu Testing (s)	Complete Request	Request per Second	Time per Request (ms)	Keterangan
Default Round Robin	0.042	200	4754.66	2.103	Distribusi merata antara worker, tidak ada request yang gagal.
Weighted Round Robin	0.041	200	4870.92	2.503	Prioritas berdasarkan weight, Lugner menerima sebagian besar request, performa sedikit lebih baik dari round robin.
Least Connection	0.040	200	5055.23	1.978	Prioritas berdasarkan beban kerja paling rendah, performa terbaik dari yang lain.
IP Hash	0.039	200	5153.84	1.940	Distribusi berdasarkan IP client, sangat efisien dengan tingkat konkurensi tinggi.
Generic Hash	0.046	200	4305.98	2.322	Distribusi berdasarkan hash dari beberapa atribut, performa baik namun tidak secepat IP Hash.

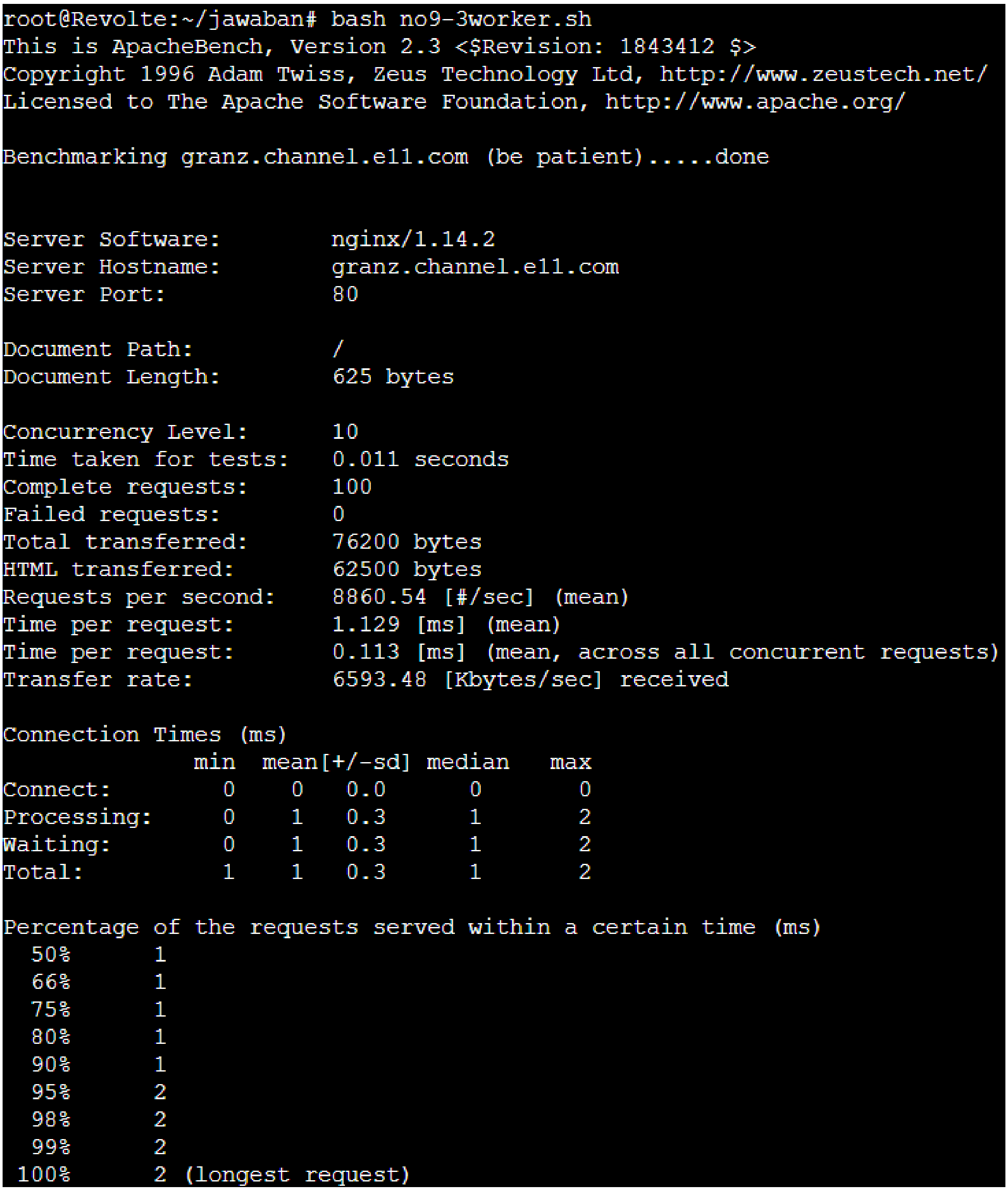
Grafik request per second



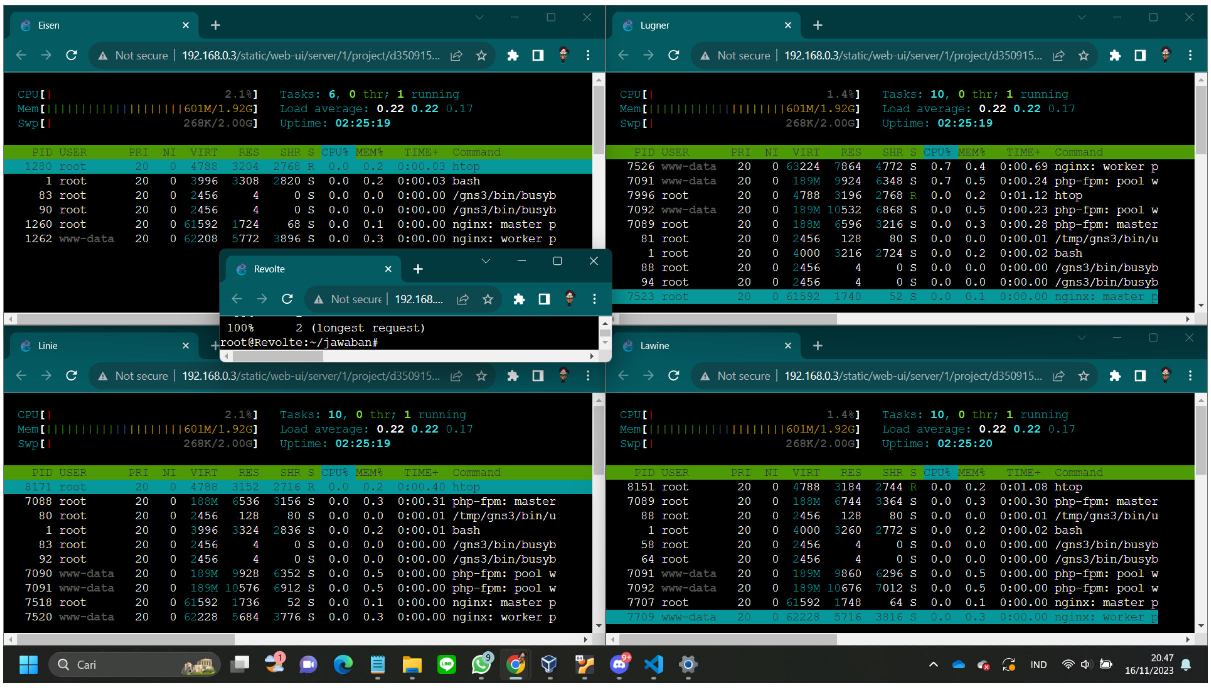
Dapat disimpulkan algoritma Least Connection dan IP Hash memberikan performa terbaik dalam hal waktu per request, yang merupakan hal penting untuk responsivitas server. Walaupun Generic Hash mempunyai waktu per request yang lebih tinggi dibandingkan yang lain, ia tetap memberikan performa yang baik dan distribusi yang merata. Weighted Round Robin menunjukkan keseimbangan antara keadilan dan performa dengan sedikit peningkatan waktu respons dibandingkan Default Round Robin. Kesimpulannya, pilihan algoritma load balancing dapat disesuaikan berdasarkan kebutuhan khusus dari lingkungan server dan jenis traffic yang dihadapi.

Analisa Jumlah Worker pada Algoritma LB Round Robin

1. **3 Worker**



```
root@Revolte:~/jawaban# bash no9-3worker.sh
This is ApacheBench, Version 2.3 <$Revision: 1843412 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking granz.channel.e11.com (be patient).....done


Server Software:        nginx/1.14.2
Server Hostname:        granz.channel.e11.com
Server Port:            80

Document Path:          /
Document Length:        625 bytes

Concurrency Level:      10
Time taken for tests:   0.011 seconds
Complete requests:      100
Failed requests:        0
Total transferred:      76200 bytes
HTML transferred:       62500 bytes
Requests per second:    8860.54 [#/sec] (mean)
Time per request:       1.129 [ms] (mean)
Time per request:       0.113 [ms] (mean, across all concurrent requests)
Transfer rate:          6593.48 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0   0.0      0       0
Processing:     0    1   0.3      1       2
Waiting:        0    1   0.3      1       2
Total:          1    1   0.3      1       2

Percentage of the requests served within a certain time (ms)
  50%      1
  66%      1
  75%      1
  80%      1
  90%      1
  95%      2
  98%      2
  99%      2
 100%      2 (longest request)
```


Eisen
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...

```
CPU[|                    2.1%]   Tasks: 6, 0 thr; 1 running
Mem[|||||||||||||||||||601M/1.92G]   Load average: 0.22 0.22 0.17
Swp[|                268K/2.00G]   Uptime: 02:25:19

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 1280 root       20   0  4788  3204  2768 R  0.0  0.2  0:00.03 htop
    1 root       20   0  3996  3308  2820 S  0.0  0.2  0:00.03 bash
   83 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   90 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 1260 root       20   0 61592  1724    68 S  0.0  0.1  0:00.00 nginx: master p
 1262 www-data   20   0 62208  5772  3896 S  0.0  0.3  0:00.00 nginx: worker p
```

Lugner
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...

```
CPU[|                    1.4%]   Tasks: 10, 0 thr; 1 running
Mem[|||||||||||||||||||601M/1.92G]   Load average: 0.22 0.22 0.17
Swp[|                268K/2.00G]   Uptime: 02:25:19

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 7526 www-data   20   0 63224  7864  4772 S  0.7  0.4  0:00.69 nginx: worker p
 7091 www-data   20   0  189M  9924  6348 S  0.7  0.5  0:00.24 php-fpm: pool w
 7996 root       20   0  4788  3196  2768 R  0.0  0.2  0:01.12 htop
 7092 www-data   20   0  189M 10532  6868 S  0.0  0.5  0:00.23 php-fpm: pool w
 7089 root       20   0  188M  6596  3216 S  0.0  0.3  0:00.28 php-fpm: master
   81 root       20   0  2456   128    80 S  0.0  0.0  0:00.01 /tmp/gns3/bin/u
    1 root       20   0  4000  3216  2724 S  0.0  0.2  0:00.02 bash
   88 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   94 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 7523 root       20   0 61592  1740    52 S  0.0  0.1  0:00.00 nginx: master p
```

```
 100%      2 (longest request)
root@Revolte:~/jawaban#
```

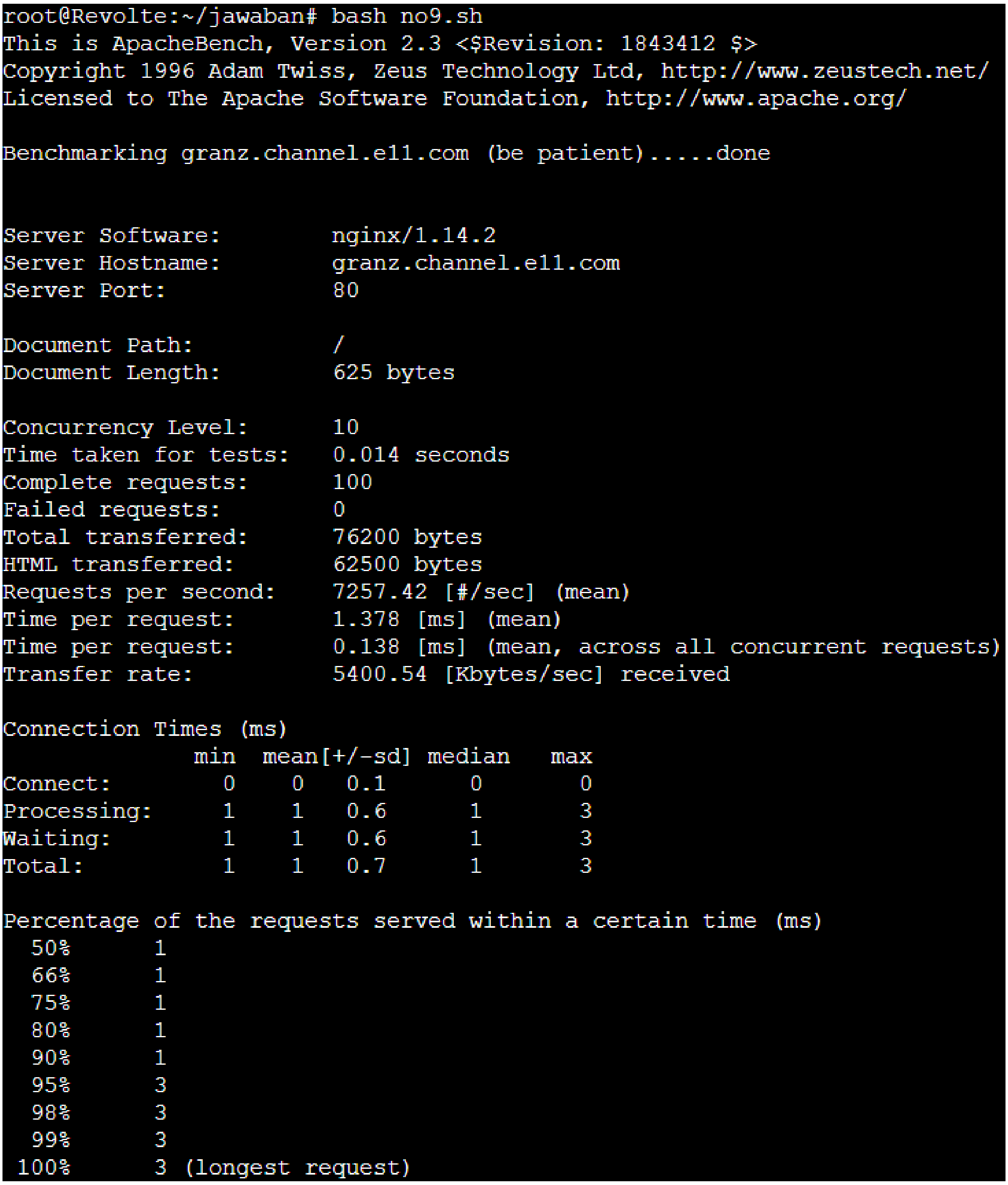
Linie
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...

```
CPU[|                    2.1%]   Tasks: 10, 0 thr; 1 running
Mem[|||||||||||||||||||601M/1.92G]   Load average: 0.22 0.22 0.17
Swp[|                268K/2.00G]   Uptime: 02:25:19

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 8171 root       20   0  4788  3152  2716 R  0.0  0.2  0:00.40 htop
 7088 root       20   0  188M  6536  3156 S  0.0  0.3  0:00.31 php-fpm: master
   80 root       20   0  2456   128    80 S  0.0  0.0  0:00.01 /tmp/gns3/bin/u
    1 root       20   0  3996  3324  2836 S  0.0  0.2  0:00.01 bash
   83 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   92 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 7090 www-data   20   0  189M  9928  6352 S  0.0  0.5  0:00.00 php-fpm: pool w
 7091 www-data   20   0  189M 10576  6912 S  0.0  0.5  0:00.00 php-fpm: pool w
 7518 root       20   0 61592  1736    52 S  0.0  0.1  0:00.00 nginx: master p
 7520 www-data   20   0 62228  5684  3776 S  0.0  0.3  0:00.00 nginx: worker p
```

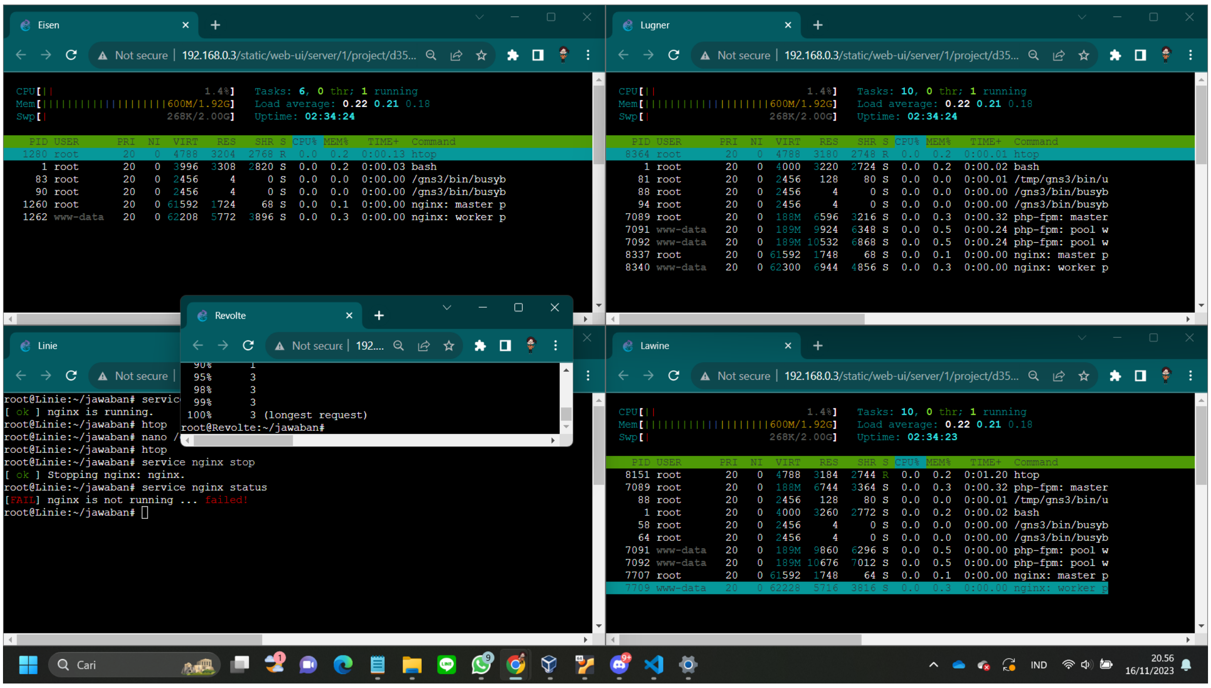
Lawine
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...

```
CPU[|                    1.4%]   Tasks: 10, 0 thr; 1 running
Mem[|||||||||||||||||||601M/1.92G]   Load average: 0.22 0.22 0.17
Swp[|                268K/2.00G]   Uptime: 02:25:20

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 8151 root       20   0  4788  3184  2744 R  0.0  0.2  0:01.08 htop
 7089 root       20   0  188M  6744  3364 S  0.0  0.3  0:00.30 php-fpm: master
   88 root       20   0  2456   128    80 S  0.0  0.0  0:00.01 /tmp/gns3/bin/u
    1 root       20   0  4000  3260  2772 S  0.0  0.2  0:00.02 bash
   58 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   64 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 7091 www-data   20   0  189M  9860  6296 S  0.0  0.5  0:00.00 php-fpm: pool w
 7092 www-data   20   0  189M 10676  7012 S  0.0  0.5  0:00.00 php-fpm: pool w
 7707 root       20   0 61592  1748    64 S  0.0  0.1  0:00.00 nginx: master p
 7709 www-data   20   0 62228  5716  3816 S  0.0  0.3  0:00.00 nginx: worker p
```

2. **2 Worker**



```
root@Revolte:~/jawaban# bash no9.sh
This is ApacheBench, Version 2.3 <$Revision: 1843412 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking granz.channel.e11.com (be patient).....done


Server Software:        nginx/1.14.2
Server Hostname:        granz.channel.e11.com
Server Port:            80

Document Path:          /
Document Length:        625 bytes

Concurrency Level:      10
Time taken for tests:   0.014 seconds
Complete requests:      100
Failed requests:        0
Total transferred:      76200 bytes
HTML transferred:       62500 bytes
Requests per second:    7257.42 [#/sec] (mean)
Time per request:       1.378 [ms] (mean)
Time per request:       0.138 [ms] (mean, across all concurrent requests)
Transfer rate:          5400.54 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0   0.1      0       0
Processing:     1    1   0.6      1       3
Waiting:        1    1   0.6      1       3
Total:          1    1   0.7      1       3

Percentage of the requests served within a certain time (ms)
  50%      1
  66%      1
  75%      1
  80%      1
  90%      1
  95%      3
  98%      3
  99%      3
 100%      3 (longest request)
```



```
  CPU[||                      1.4%]   Tasks: 6, 0 thr; 1 running
  Mem[|||||||||||||||||||600M/1.92G]   Load average: 0.22 0.21 0.18
  Swp[|                  268K/2.00G]   Uptime: 02:34:24

    PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
   1280 root       20   0  4788  3204  2768 R  0.0  0.2  0:00.13 htop
      1 root       20   0  3996  3308  2820 S  0.0  0.2  0:00.03 bash
     83 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
     90 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   1260 root       20   0 61592  1724    68 S  0.0  0.1  0:00.00 nginx: master p
   1262 www-data   20   0 62208  5772  3896 S  0.0  0.3  0:00.00 nginx: worker p
```

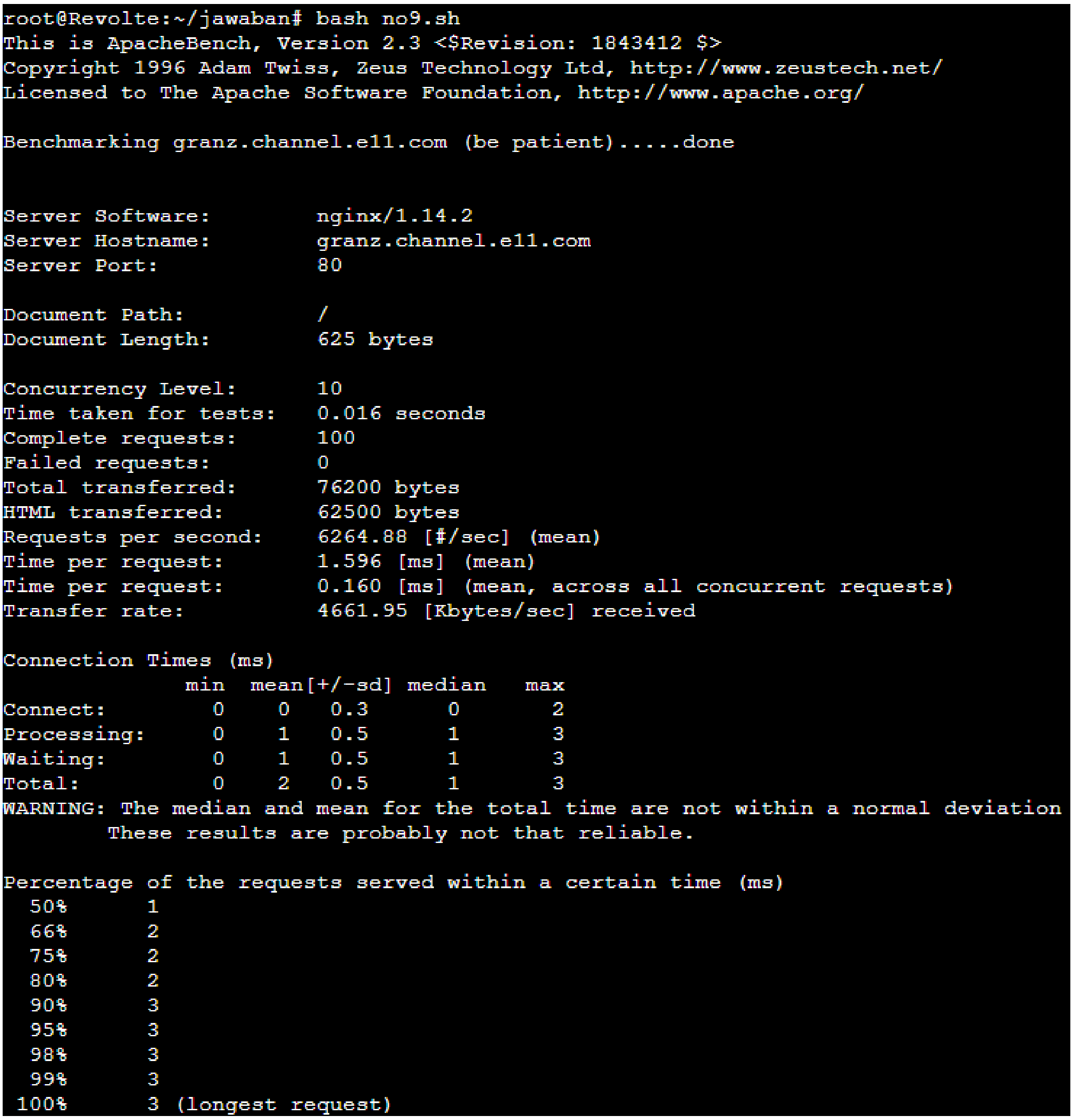
```
  CPU[||                      1.4%]   Tasks: 10, 0 thr; 1 running
  Mem[|||||||||||||||||||600M/1.92G]   Load average: 0.22 0.21 0.18
  Swp[|                  268K/2.00G]   Uptime: 02:34:24

    PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
   8364 root       20   0  4788  3180  2748 R  0.0  0.2  0:00.01 htop
      1 root       20   0  4000  3220  2724 S  0.0  0.2  0:00.02 bash
     81 root       20   0  2456   128    80 S  0.0  0.0  0:00.01 /tmp/gns3/bin/u
     88 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
     94 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   7089 root       20   0  188M  6596  3216 S  0.0  0.3  0:00.32 php-fpm: master
   7091 www-data   20   0  189M  9924  6348 S  0.0  0.5  0:00.24 php-fpm: pool w
   7092 www-data   20   0  189M 10532  6868 S  0.0  0.5  0:00.24 php-fpm: pool w
   8337 root       20   0 61592  1748    68 S  0.0  0.1  0:00.00 nginx: master p
   8340 www-data   20   0 62300  6944  4856 S  0.0  0.3  0:00.00 nginx: worker p
```

```
  90%      1
  95%      3
  98%      3
  99%      3
 100%      3 (longest request)
root@Revolte:~/jawaban#
```

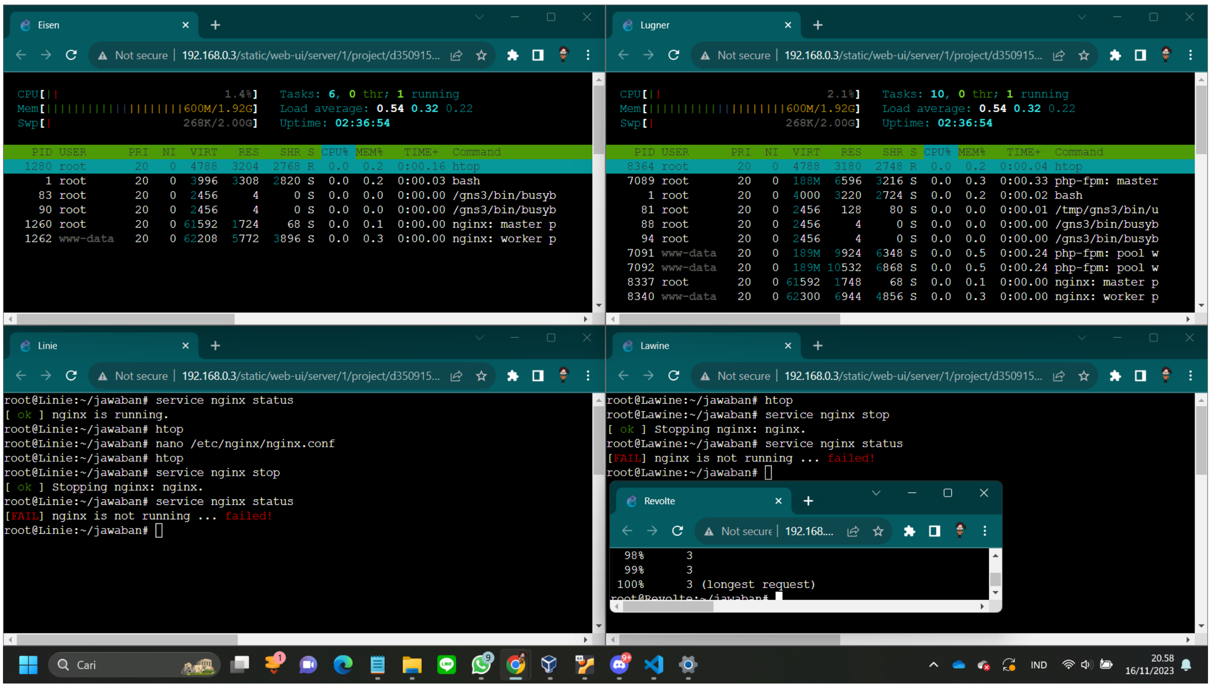
```
root@Linie:~/jawaban# servic
[ ok ] nginx is running.
root@Linie:~/jawaban# htop
root@Linie:~/jawaban# nano /
root@Linie:~/jawaban# htop
root@Linie:~/jawaban# service nginx stop
[ ok ] Stopping nginx: nginx.
root@Linie:~/jawaban# service nginx status
[FAIL] nginx is not running ... failed!
root@Linie:~/jawaban# 
```

```
  CPU[||                      1.4%]   Tasks: 10, 0 thr; 1 running
  Mem[|||||||||||||||||||600M/1.92G]   Load average: 0.22 0.21 0.18
  Swp[|                  268K/2.00G]   Uptime: 02:34:23

    PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
   8151 root       20   0  4788  3184  2744 R  0.0  0.2  0:01.20 htop
   7089 root       20   0  188M  6744  3364 S  0.0  0.3  0:00.32 php-fpm: master
     88 root       20   0  2456   128    80 S  0.0  0.0  0:00.01 /tmp/gns3/bin/u
      1 root       20   0  4000  3260  2772 S  0.0  0.2  0:00.02 bash
     58 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
     64 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   7091 www-data   20   0  189M  9860  6296 S  0.0  0.5  0:00.00 php-fpm: pool w
   7092 www-data   20   0  189M 10676  7012 S  0.0  0.5  0:00.00 php-fpm: pool w
   7707 root       20   0 61592  1748    64 S  0.0  0.1  0:00.00 nginx: master p
   7709 www-data   20   0 62228  5716  3816 S  0.0  0.3  0:00.00 nginx: worker p
```

3. 1 worker



```
root@Revolte:~/jawaban# bash no9.sh
This is ApacheBench, Version 2.3 <$Revision: 1843412 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking granz.channel.e11.com (be patient).....done


Server Software:        nginx/1.14.2
Server Hostname:        granz.channel.e11.com
Server Port:            80

Document Path:          /
Document Length:        625 bytes

Concurrency Level:      10
Time taken for tests:   0.016 seconds
Complete requests:      100
Failed requests:        0
Total transferred:      76200 bytes
HTML transferred:       62500 bytes
Requests per second:    6264.88 [#/sec] (mean)
Time per request:       1.596 [ms] (mean)
Time per request:       0.160 [ms] (mean, across all concurrent requests)
Transfer rate:          4661.95 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0   0.3      0       2
Processing:     0    1   0.5      1       3
Waiting:        0    1   0.5      1       3
Total:          0    2   0.5      1       3
WARNING: The median and mean for the total time are not within a normal deviation
        These results are probably not that reliable.

Percentage of the requests served within a certain time (ms)
  50%      1
  66%      2
  75%      2
  80%      2
  90%      3
  95%      3
  98%      3
  99%      3
 100%      3 (longest request)
```


Eisen
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...
Lugner
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...
Linie
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...
Lawine
Not secure | 192.168.0.3/static/web-ui/server/1/project/d350915...
Revolte
Not secure | 192.168....
Cari
IND
20.58
16/11/2023

```
CPU[||                        1.4%]   Tasks: 6, 0 thr; 1 running
Mem[||||||||||||||||||||600M/1.92G]   Load average: 0.54 0.32 0.22
Swp[|                   268K/2.00G]   Uptime: 02:36:54

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 1280 root       20   0  4788  3204  2768 R  0.0  0.2  0:00.16 htop
    1 root       20   0  3996  3308  2820 S  0.0  0.2  0:00.03 bash
   83 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   90 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 1260 root       20   0 61592  1724    68 S  0.0  0.1  0:00.00 nginx: master p
 1262 www-data   20   0 62208  5772  3896 S  0.0  0.3  0:00.00 nginx: worker p
```

```
CPU[||                        2.1%]   Tasks: 10, 0 thr; 1 running
Mem[||||||||||||||||||||600M/1.92G]   Load average: 0.54 0.32 0.22
Swp[|                   268K/2.00G]   Uptime: 02:36:54

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
 8364 root       20   0  4788  3180  2748 R  0.0  0.2  0:00.04 htop
 7089 root       20   0  188M  6596  3216 S  0.0  0.3  0:00.33 php-fpm: master
    1 root       20   0  4000  3220  2724 S  0.0  0.2  0:00.02 bash
   81 root       20   0  2456   128    80 S  0.0  0.0  0:00.01 /tmp/gns3/bin/u
   88 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
   94 root       20   0  2456     4     0 S  0.0  0.0  0:00.00 /gns3/bin/busyb
 7091 www-data   20   0  189M  9924  6348 S  0.0  0.5  0:00.24 php-fpm: pool w
 7092 www-data   20   0  189M 10532  6868 S  0.0  0.5  0:00.24 php-fpm: pool w
 8337 root       20   0 61592  1748    68 S  0.0  0.1  0:00.00 nginx: master p
 8340 www-data   20   0 62300  6944  4856 S  0.0  0.3  0:00.00 nginx: worker p
```

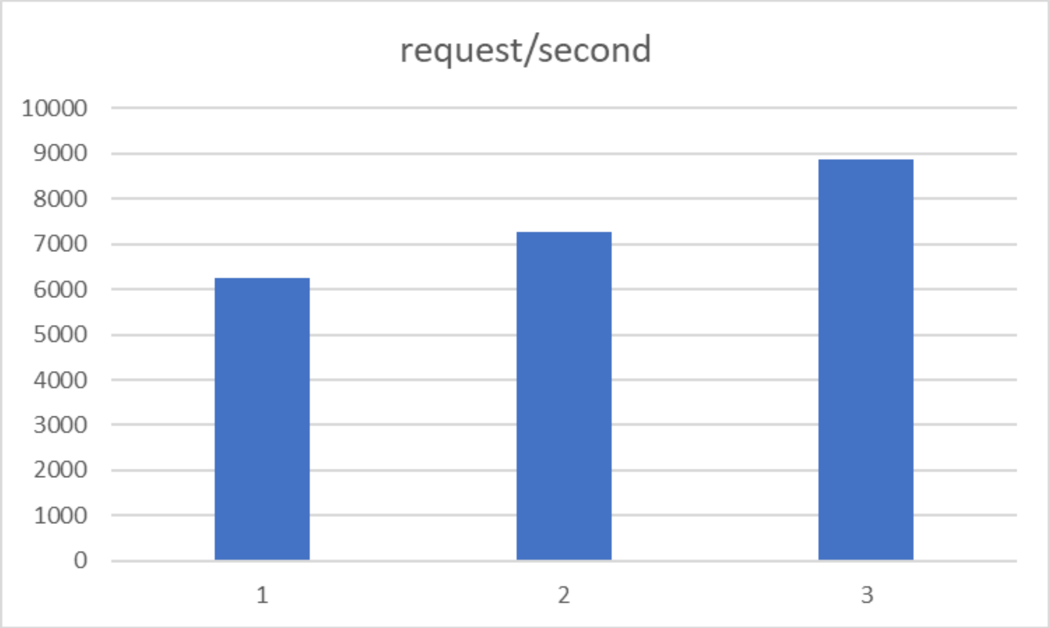
```
root@Linie:~/jawaban# service nginx status
[ ok ] nginx is running.
root@Linie:~/jawaban# htop
root@Linie:~/jawaban# nano /etc/nginx/nginx.conf
root@Linie:~/jawaban# htop
root@Linie:~/jawaban# service nginx stop
[ ok ] Stopping nginx: nginx.
root@Linie:~/jawaban# service nginx status
[FAIL] nginx is not running ... failed!
root@Linie:~/jawaban# 
```

```
root@Lawine:~/jawaban# htop
root@Lawine:~/jawaban# service nginx stop
[ ok ] Stopping nginx: nginx.
root@Lawine:~/jawaban# service nginx status
[FAIL] nginx is not running ... failed!
root@Lawine:~/jawaban# 
```

```
  98%      3
  99%      3
 100%      3 (longest request)
root@Revolte:~/jawaban# 
```

4. Kesimpulan

a. Grafik Request/Second



b. Analisa

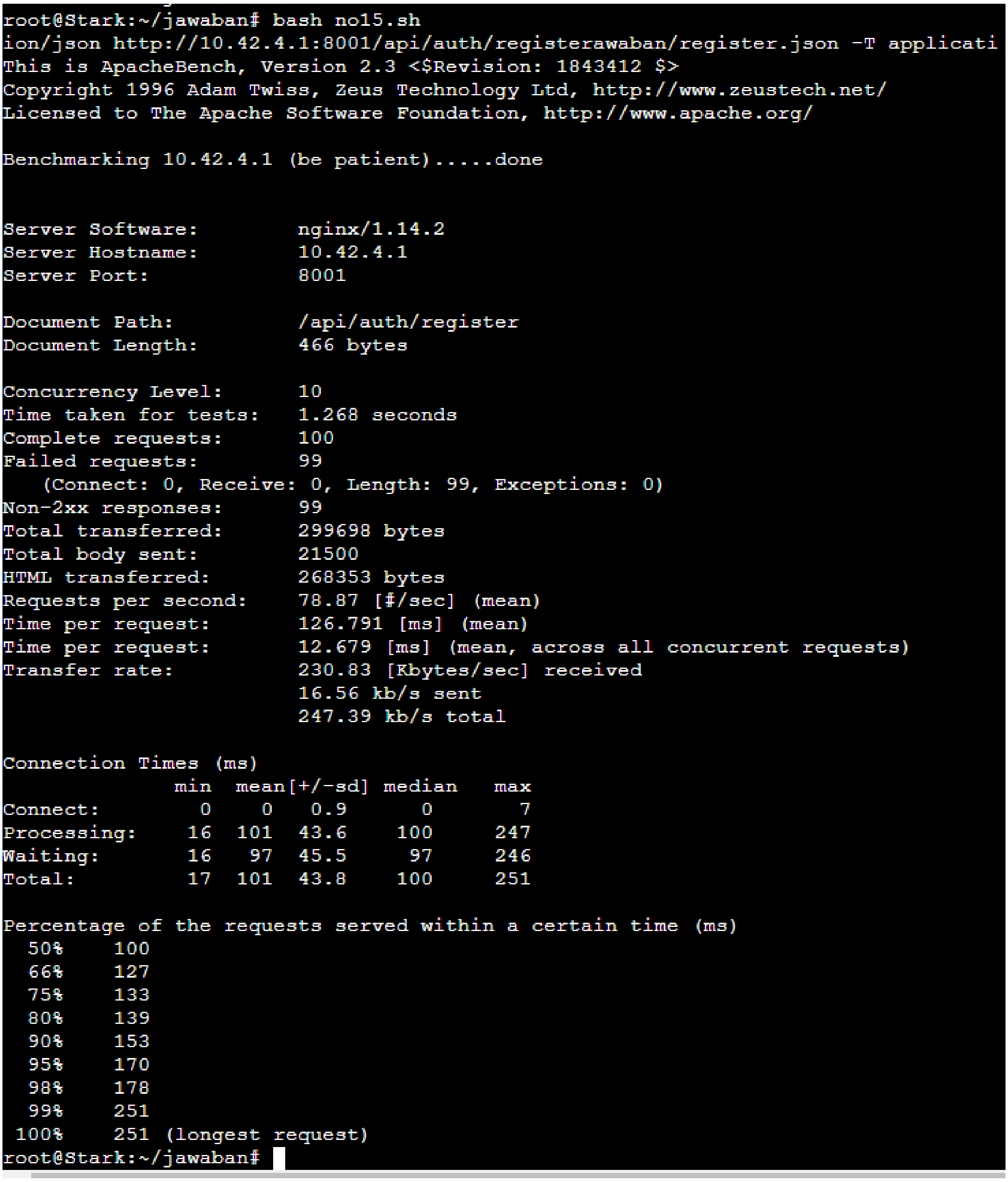
Jumlah Worker	Request/ Second	Time per Request (ms)	Failed Request	Data Transfer Rate (Kbytes/sec)	Consistent Connection Time (ms)
3	8860.54	1.129	0	6593.48	1 - 2
2	7257.42	1.378	0	5400.54	1 - 3

1	6254.88	1.596	0	4661.95	1 - 3

Dapat disimpulkan bahwa peningkatan jumlah worker dalam algoritma Round Robin meningkatkan jumlah request yang dapat dihandle per second dan meningkatkan laju transfer data. Time per request juga menjadi lebih cepat dengan lebih banyak worker. Tidak ada request yang gagal di semua konfigurasi, yang menunjukkan keandalan sistem. Namun, waktu koneksi yang konsisten menunjukkan sedikit peningkatan dalam variasi waktu dengan jumlah worker yang lebih sedikit. Ini dapat mengindikasikan bahwa sistem lebih efisien dengan lebih banyak worker dalam menangani request yang datang.

Response dan Hasil Testing API Request pada Riegel Channel

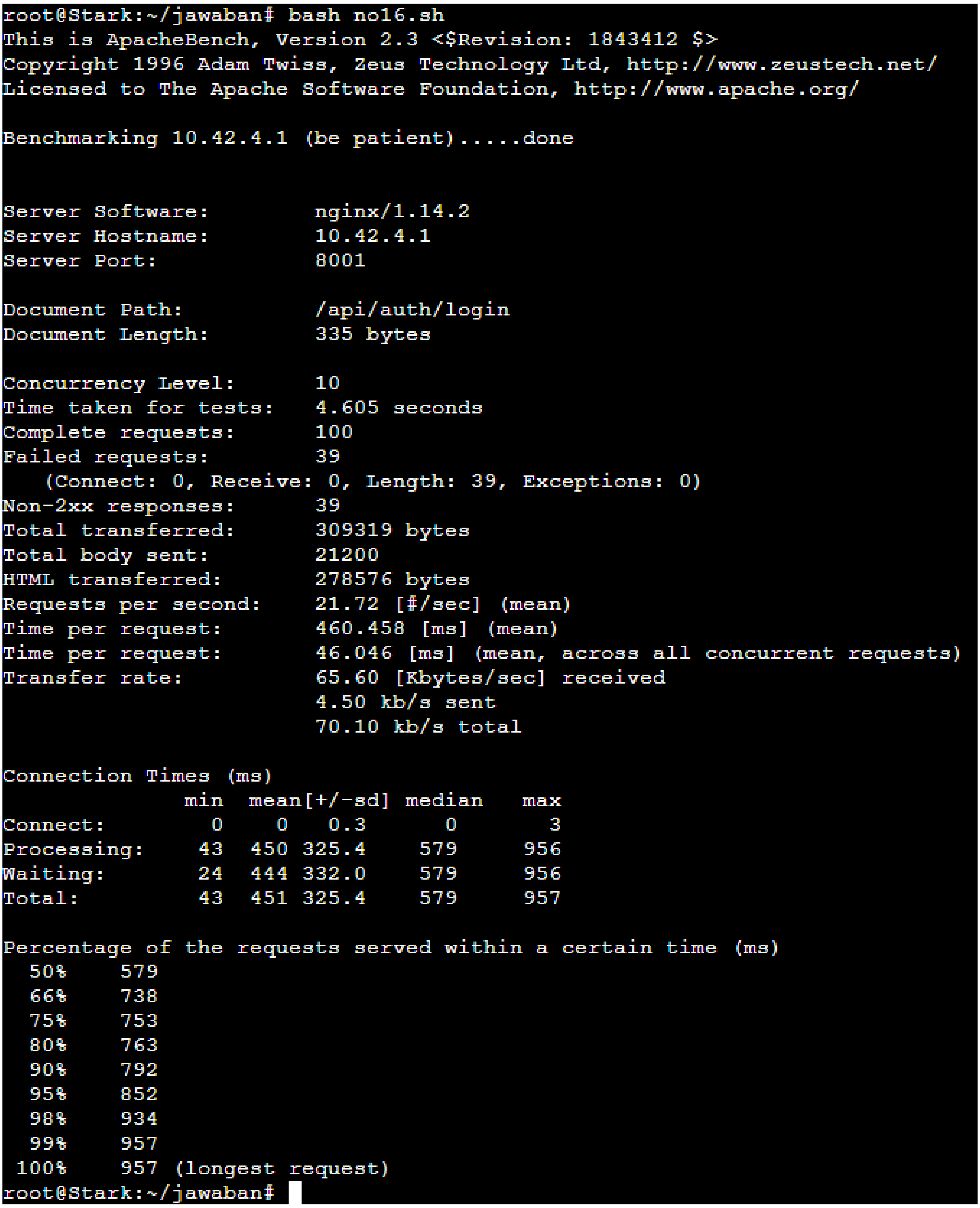
15. POST /auth/register



```
root@Stark:~/jawaban# bash no15.sh
ion/json http://10.42.4.1:8001/api/auth/registerawaban/register.json -T applicati
This is ApacheBench, Version 2.3 <$Revision: 1843412 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 10.42.4.1 (be patient).....done


Server Software:        nginx/1.14.2
Server Hostname:        10.42.4.1
Server Port:            8001

Document Path:          /api/auth/register
Document Length:        466 bytes

Concurrency Level:      10
Time taken for tests:   1.268 seconds
Complete requests:      100
Failed requests:        99
   (Connect: 0, Receive: 0, Length: 99, Exceptions: 0)
Non-2xx responses:      99
Total transferred:      299698 bytes
Total body sent:        21500
HTML transferred:       268353 bytes
Requests per second:    78.87 [#/sec] (mean)
Time per request:       126.791 [ms] (mean)
Time per request:       12.679 [ms] (mean, across all concurrent requests)
Transfer rate:          230.83 [Kbytes/sec] received
                        16.56 kb/s sent
                        247.39 kb/s total

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0   0.9      0       7
Processing:    16  101  43.6    100     247
Waiting:       16   97  45.5     97     246
Total:         17  101  43.8    100     251

Percentage of the requests served within a certain time (ms)
  50%    100
  66%    127
  75%    133
  80%    139
  90%    153
  95%    170
  98%    178
  99%    251
 100%    251 (longest request)
root@Stark:~/jawaban# 
```

Berdasarkan hasil benchmark 100 request, hanya 1 request yang berhasil untuk POST /auth/register karena data users merupakan data yang unik dan username tidak boleh sama. Oleh sebab itu, hanya 1 request saja yang diproses.

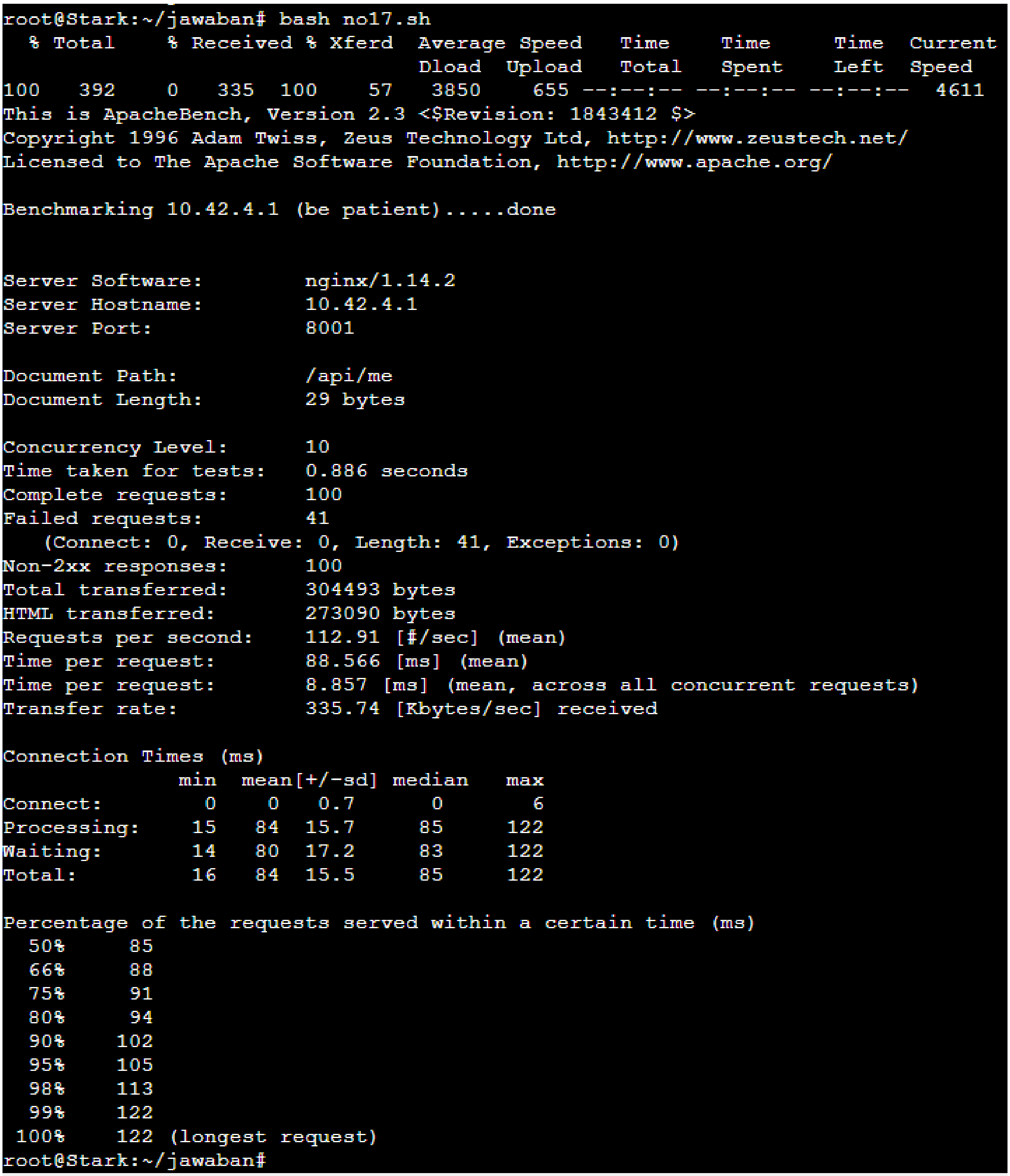
16. POST /auth/login



```
root@Stark:~/jawaban# bash no16.sh
This is ApacheBench, Version 2.3 <$Revision: 1843412 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 10.42.4.1 (be patient).....done


Server Software:        nginx/1.14.2
Server Hostname:        10.42.4.1
Server Port:            8001

Document Path:          /api/auth/login
Document Length:        335 bytes

Concurrency Level:      10
Time taken for tests:   4.605 seconds
Complete requests:      100
Failed requests:        39
   (Connect: 0, Receive: 0, Length: 39, Exceptions: 0)
Non-2xx responses:      39
Total transferred:      309319 bytes
Total body sent:        21200
HTML transferred:       278576 bytes
Requests per second:    21.72 [#/sec] (mean)
Time per request:       460.458 [ms] (mean)
Time per request:       46.046 [ms] (mean, across all concurrent requests)
Transfer rate:          65.60 [Kbytes/sec] received
                        4.50 kb/s sent
                        70.10 kb/s total

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0   0.3      0       3
Processing:    43  450 325.4    579     956
Waiting:       24  444 332.0    579     956
Total:         43  451 325.4    579     957

Percentage of the requests served within a certain time (ms)
  50%    579
  66%    738
  75%    753
  80%    763
  90%    792
  95%    852
  98%    934
  99%    957
 100%    957 (longest request)
root@Stark:~/jawaban#
```

Berdasarkan hasil benchmark 100 request, hanya 61 request yang berhasil untuk dilakukan proses POST /auth/login dan 39 request lainnya gagal. Hal ini dapat disebabkan karena worker yang digunakan hanya 1 sehingga worker tidak sanggup untuk menangani 100 request sekaligus.

17. GET /me



```
root@Stark:~/jawaban# bash no17.sh
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   392    0   335  100    57   3850    655 --:--:-- --:--:-- --:--:--  4611
This is ApacheBench, Version 2.3 <$Revision: 1843412 $>
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Benchmarking 10.42.4.1 (be patient).....done


Server Software:        nginx/1.14.2
Server Hostname:        10.42.4.1
Server Port:            8001

Document Path:          /api/me
Document Length:        29 bytes

Concurrency Level:      10
Time taken for tests:   0.886 seconds
Complete requests:      100
Failed requests:        41
   (Connect: 0, Receive: 0, Length: 41, Exceptions: 0)
Non-2xx responses:      100
Total transferred:      304493 bytes
HTML transferred:       273090 bytes
Requests per second:    112.91 [#/sec] (mean)
Time per request:       88.566 [ms] (mean)
Time per request:       8.857 [ms] (mean, across all concurrent requests)
Transfer rate:          335.74 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0   0.7      0       6
Processing:    15   84  15.7     85     122
Waiting:       14   80  17.2     83     122
Total:         16   84  15.5     85     122

Percentage of the requests served within a certain time (ms)
  50%     85
  66%     88
  75%     91
  80%     94
  90%    102
  95%    105
  98%    113
  99%    122
 100%    122 (longest request)
root@Stark:~/jawaban#
```

Berdasarkan hasil benchmark 100 request, hanya 59 request yang berhasil untuk dilakukan proses GET /me dan 41 request lainnya gagal. Hal ini dapat disebabkan karena worker yang digunakan hanya 1 sehingga worker tidak sanggup untuk menangani 100 request sekaligus.

Hasil Testing Implementasi PHP-FPM

Notes:

- Untuk setiap percobaan pm.max_children akan naik 20, dan untuk pm yang lain akan naik 5
- Percobaan akan melakukan benchmark untuk POST /auth/login melalui load balancer dengan IP 10.42.2.2

1. **Script default:**

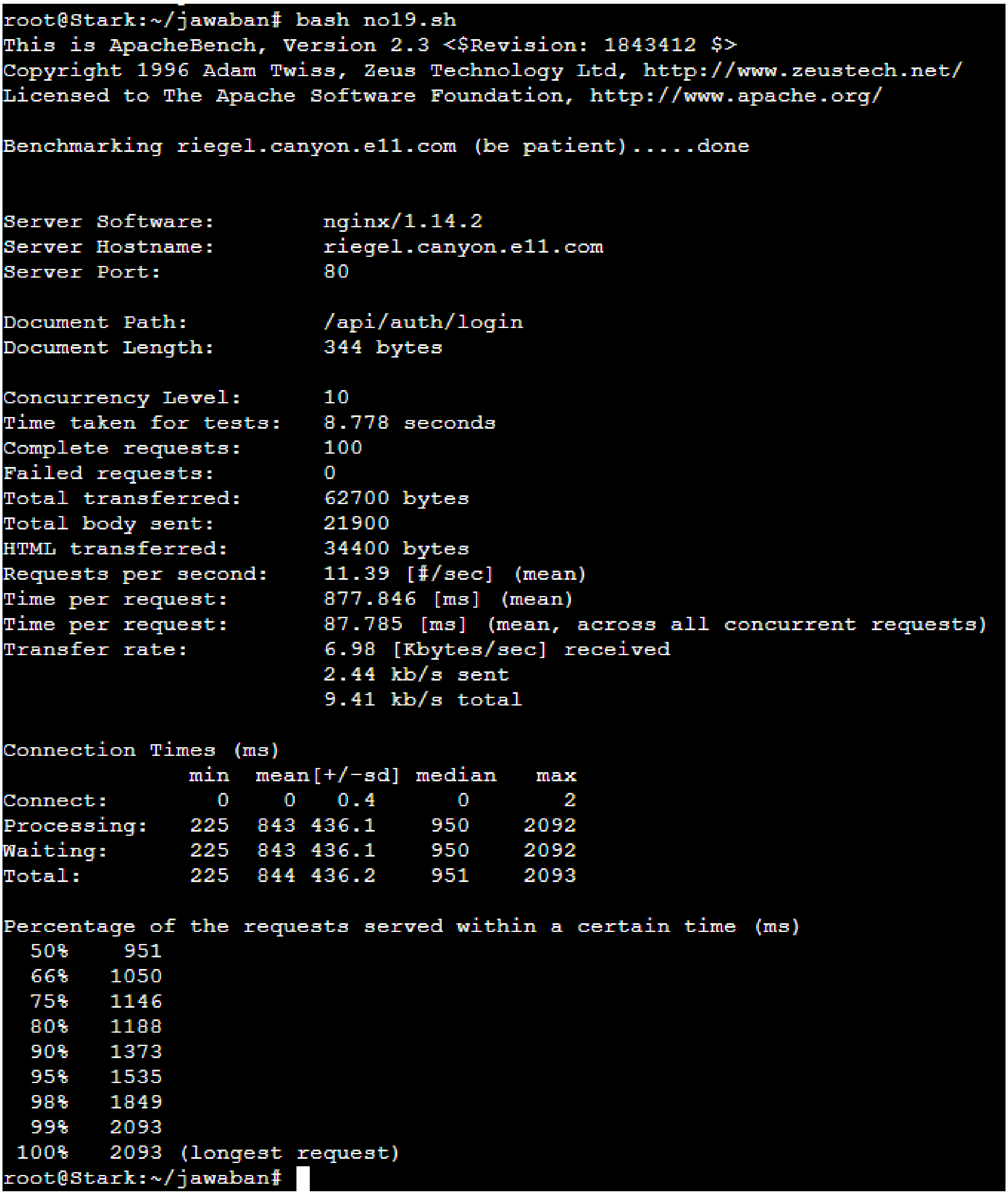
```
# Setup Awal
echo '[www]
user = www-data
group = www-data
listen = /run/php/php8.0-fpm.sock
listen.owner = www-data
listen.group = www-data
php_admin_value[disable_functions] =
exec,passthru,shell_exec,system
php_admin_flag[allow_url_fopen] = off

; Choose how the process manager will control the number of child
processes.

pm = dynamic
pm.max_children = 5
pm.start_servers = 2
pm.min_spare_servers = 1
pm.max_spare_servers = 3' > /etc/php/8.0/fpm/pool.d/www.conf

service php8.0-fpm restart
```

Hasil percobaan dengan script default:



```
root@Stark:~/jawaban# bash no19.sh
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Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking riegel.canyon.e11.com (be patient).....done


Server Software:        nginx/1.14.2
Server Hostname:        riegel.canyon.e11.com
Server Port:            80

Document Path:          /api/auth/login
Document Length:        344 bytes

Concurrency Level:      10
Time taken for tests:   8.778 seconds
Complete requests:      100
Failed requests:        0
Total transferred:      62700 bytes
Total body sent:        21900
HTML transferred:       34400 bytes
Requests per second:    11.39 [#/sec] (mean)
Time per request:       877.846 [ms] (mean)
Time per request:       87.785 [ms] (mean, across all concurrent requests)
Transfer rate:          6.98 [Kbytes/sec] received
                        2.44 kb/s sent
                        9.41 kb/s total

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0   0.4      0       2
Processing:   225  843 436.1    950    2092
Waiting:      225  843 436.1    950    2092
Total:        225  844 436.2    951    2093

Percentage of the requests served within a certain time (ms)
  50%    951
  66%   1050
  75%   1146
  80%   1188
  90%   1373
  95%   1535
  98%   1849
  99%   2093
 100%   2093 (longest request)
root@Stark:~/jawaban#
```
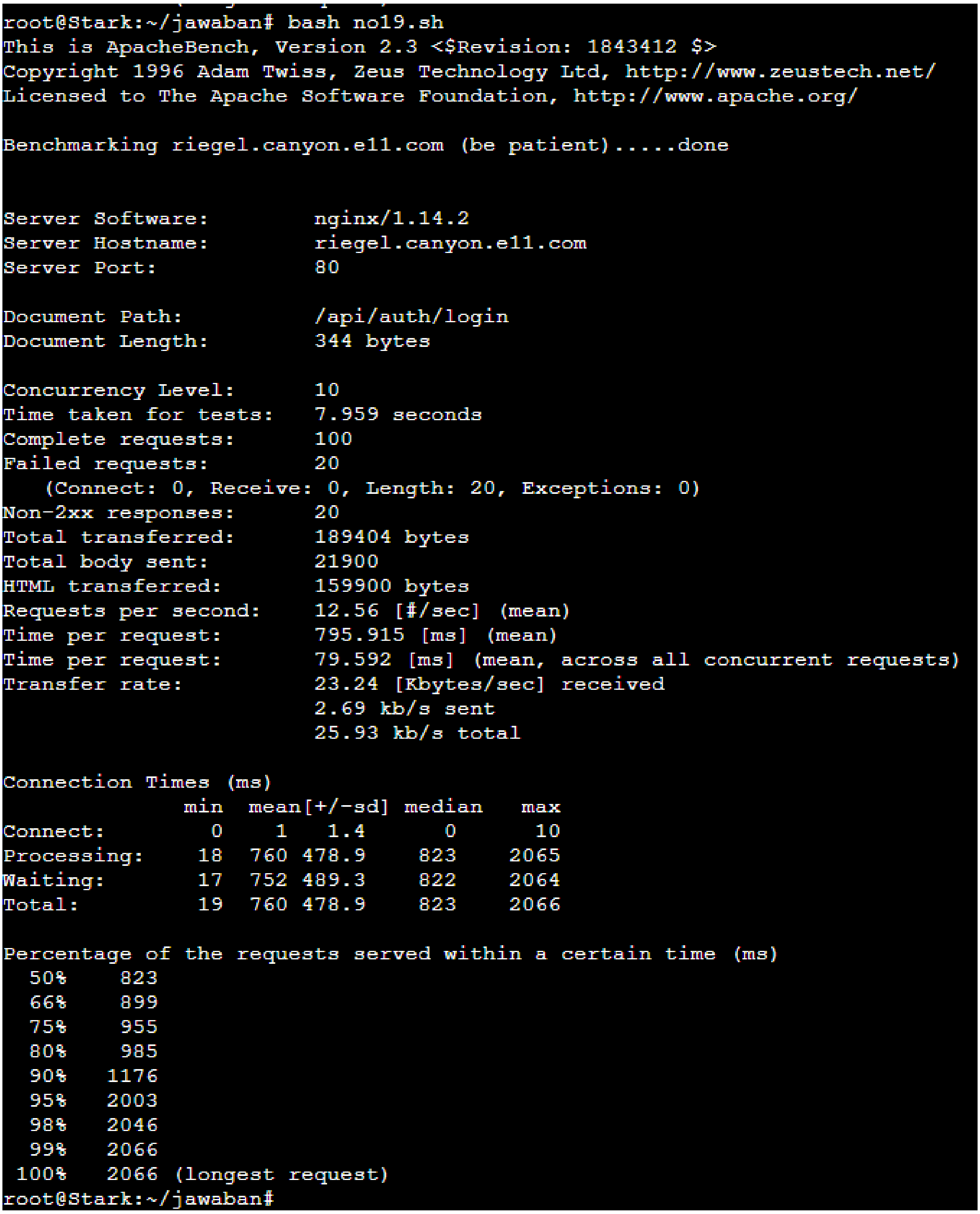

2. **Percobaan 1:**

Script:

```
echo '[www]
user = www-data
group = www-data
listen = /run/php/php8.0-fpm.sock
listen.owner = www-data
listen.group = www-data
php_admin_value[disable_functions] = exec,passthru,shell_exec,system
php_admin_flag[allow_url_fopen] = off

; Choose how the process manager will control the number of child processes.

pm = dynamic
pm.max_children = 25
pm.start_servers = 7
pm.min_spare_servers = 6
pm.max_spare_servers = 8
' > /etc/php/8.0/fpm/pool.d/www.conf

service php8.0-fpm restart
```

Hasil percobaan 1:



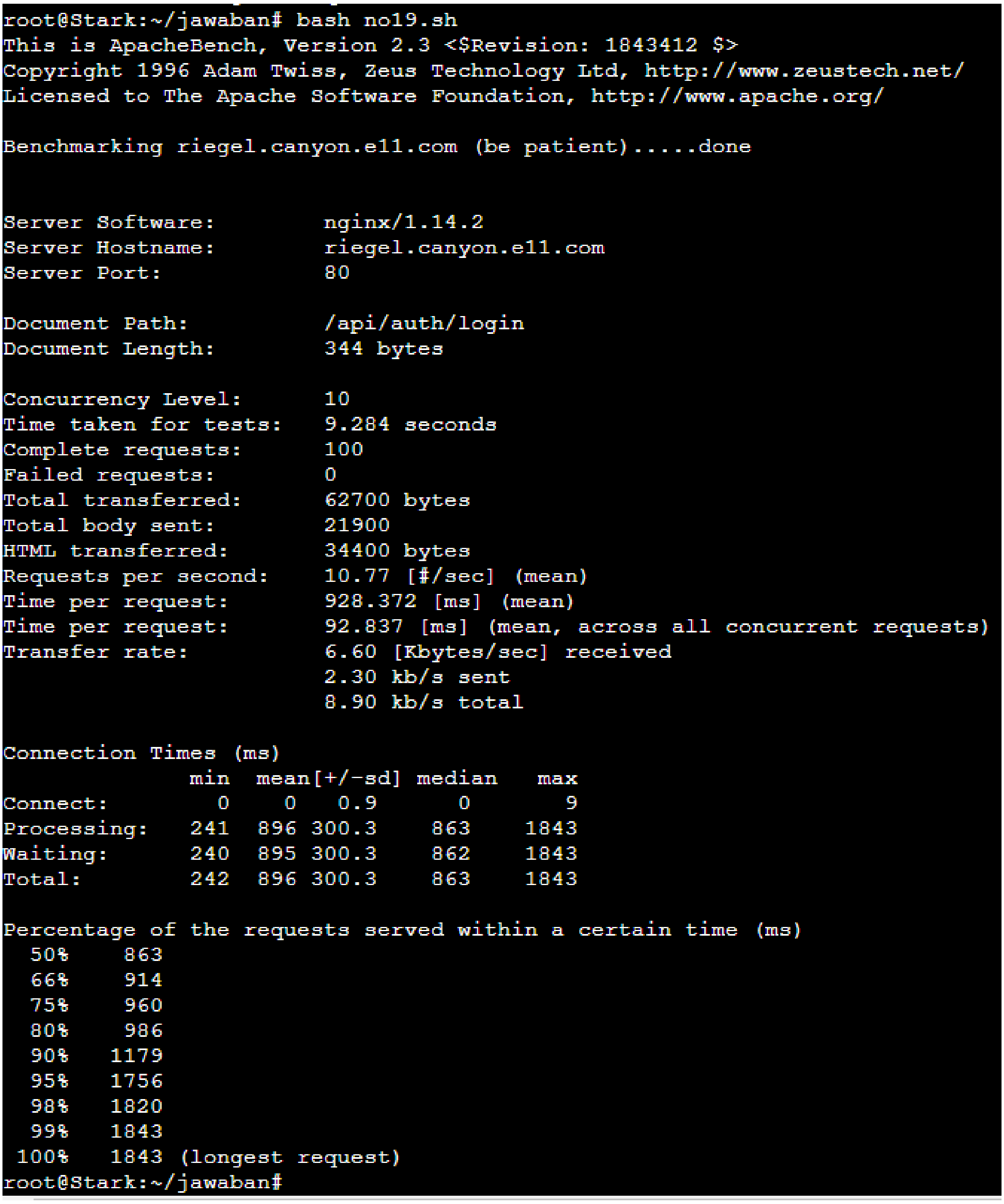
```
root@Stark:~/jawaban# bash no19.sh
This is ApacheBench, Version 2.3 <$Revision: 1843412 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking riegel.canyon.e11.com (be patient).....done


Server Software:        nginx/1.14.2
Server Hostname:        riegel.canyon.e11.com
Server Port:            80

Document Path:          /api/auth/login
Document Length:        344 bytes

Concurrency Level:      10
Time taken for tests:   7.959 seconds
Complete requests:      100
Failed requests:        20
   (Connect: 0, Receive: 0, Length: 20, Exceptions: 0)
Non-2xx responses:      20
Total transferred:      189404 bytes
Total body sent:        21900
HTML transferred:       159900 bytes
Requests per second:    12.56 [#/sec] (mean)
Time per request:       795.915 [ms] (mean)
Time per request:       79.592 [ms] (mean, across all concurrent requests)
Transfer rate:          23.24 [Kbytes/sec] received
                        2.69 kb/s sent
                        25.93 kb/s total

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    1   1.4      0      10
Processing:    18  760 478.9    823    2065
Waiting:       17  752 489.3    822    2064
Total:         19  760 478.9    823    2066

Percentage of the requests served within a certain time (ms)
  50%    823
  66%    899
  75%    955
  80%    985
  90%   1176
  95%   2003
  98%   2046
  99%   2066
 100%   2066 (longest request)
root@Stark:~/jawaban#
```

3. **Percobaan 2:**

Script:

```
echo '
[www]
user = www-data
group = www-data
listen = /run/php/php8.0-fpm.sock
listen.owner = www-data
listen.group = www-data
php_admin_value[disable_functions] =
exec,passthru,shell_exec,system
php_admin_flag[allow_url_fopen] = off

; Choose how the process manager will control the number of child
processes.

pm = dynamic
pm.max_children = 45
pm.start_servers = 12
pm.min_spare_servers = 11
pm.max_spare_servers = 13
' > /etc/php/8.0/fpm/pool.d/www.conf

service php8.0-fpm restart
```

Hasil percobaan 2:



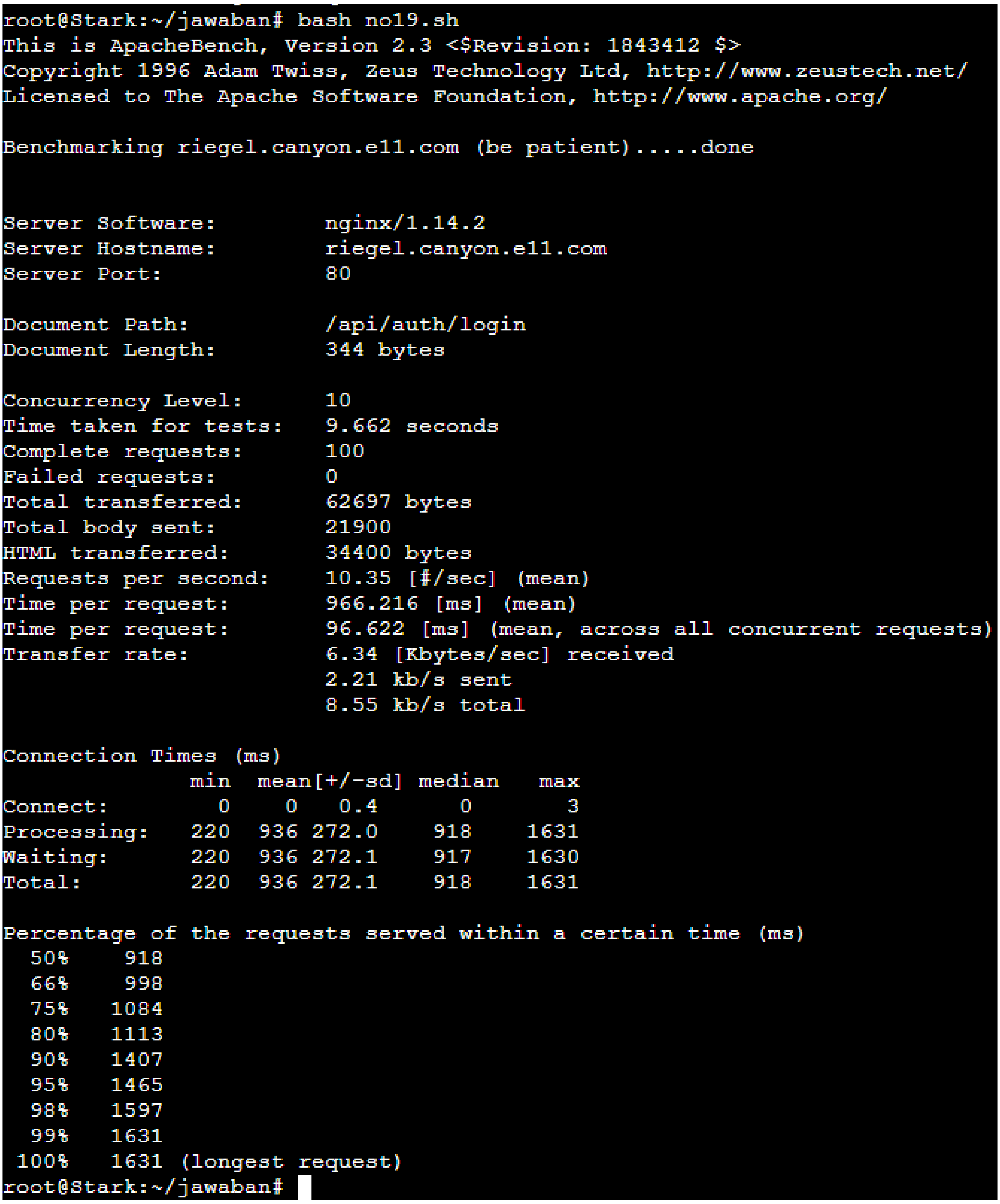
```
root@Stark:~/jawaban# bash no19.sh
This is ApacheBench, Version 2.3 <$Revision: 1843412 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking riegel.canyon.e11.com (be patient).....done


Server Software:        nginx/1.14.2
Server Hostname:        riegel.canyon.e11.com
Server Port:            80

Document Path:          /api/auth/login
Document Length:        344 bytes

Concurrency Level:      10
Time taken for tests:   9.284 seconds
Complete requests:      100
Failed requests:        0
Total transferred:      62700 bytes
Total body sent:        21900
HTML transferred:       34400 bytes
Requests per second:    10.77 [#/sec] (mean)
Time per request:       928.372 [ms] (mean)
Time per request:       92.837 [ms] (mean, across all concurrent requests)
Transfer rate:          6.60 [Kbytes/sec] received
                        2.30 kb/s sent
                        8.90 kb/s total

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0   0.9      0       9
Processing:   241  896 300.3    863    1843
Waiting:      240  895 300.3    862    1843
Total:        242  896 300.3    863    1843

Percentage of the requests served within a certain time (ms)
  50%    863
  66%    914
  75%    960
  80%    986
  90%   1179
  95%   1756
  98%   1820
  99%   1843
 100%   1843 (longest request)
root@Stark:~/jawaban#
```

4. **Percobaan 3:**

Script:

```
echo '
[www]
user = www-data
group = www-data
listen = /run/php/php8.0-fpm.sock
listen.owner = www-data
listen.group = www-data
php_admin_value[disable_functions] =
exec,passthru,shell_exec,system
php_admin_flag[allow_url_fopen] = off

; Choose how the process manager will control the number of child
processes.

pm = dynamic
pm.max_children = 65
pm.start_servers = 17
pm.min_spare_servers = 16
pm.max_spare_servers = 18
' > /etc/php/8.0/fpm/pool.d/www.conf

service php8.0-fpm restart
```

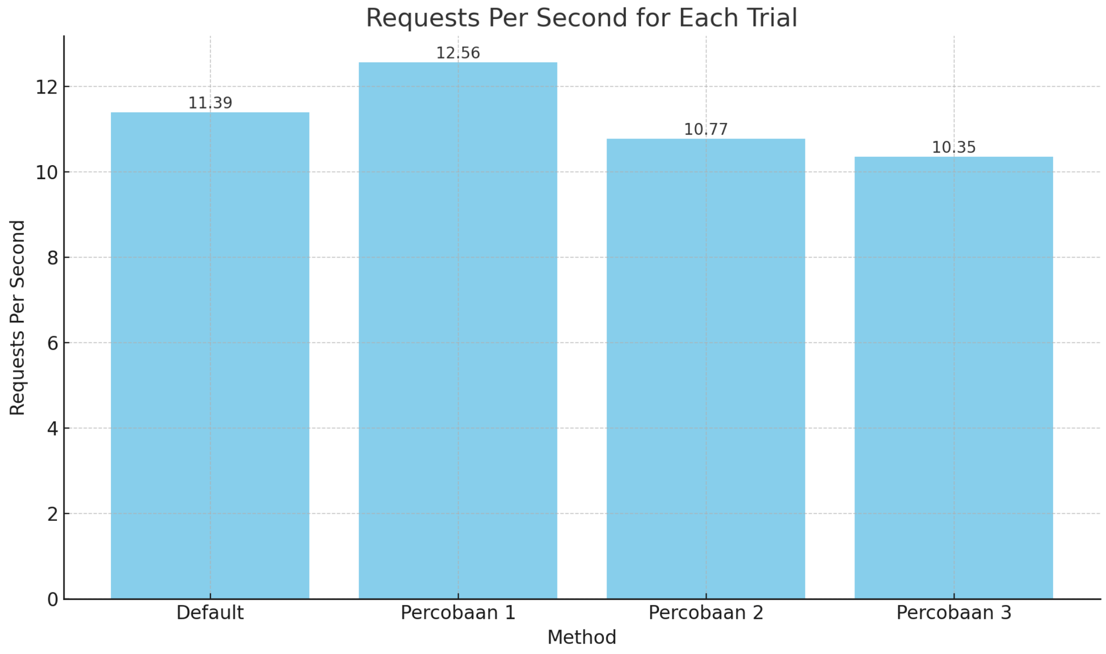
Hasil percobaan 3:



```
root@Stark:~/jawaban# bash no19.sh
This is ApacheBench, Version 2.3 <$Revision: 1843412 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking riegel.canyon.e11.com (be patient).....done


Server Software:        nginx/1.14.2
Server Hostname:        riegel.canyon.e11.com
Server Port:            80

Document Path:          /api/auth/login
Document Length:        344 bytes

Concurrency Level:      10
Time taken for tests:   9.662 seconds
Complete requests:      100
Failed requests:        0
Total transferred:      62697 bytes
Total body sent:        21900
HTML transferred:       34400 bytes
Requests per second:    10.35 [#/sec] (mean)
Time per request:       966.216 [ms] (mean)
Time per request:       96.622 [ms] (mean, across all concurrent requests)
Transfer rate:          6.34 [Kbytes/sec] received
                        2.21 kb/s sent
                        8.55 kb/s total

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0   0.4      0       3
Processing:   220  936 272.0    918    1631
Waiting:      220  936 272.1    917    1630
Total:        220  936 272.1    918    1631

Percentage of the requests served within a certain time (ms)
  50%    918
  66%    998
  75%   1084
  80%   1113
  90%   1407
  95%   1465
  98%   1597
  99%   1631
 100%   1631 (longest request)
root@Stark:~/jawaban# 
```

5. Kesimpulan

	max_children	start_servers	min_spare_servers	max_spare_servers
Default	5	2	1	3
Percobaan 1	25	7	6	8
Percobaan 2	45	12	11	13
Percobaan 3	65	17	16	18



Dari grafik diagram batang yang telah dibuat, kita dapat melihat perbandingan jumlah request per detik (requests per second)

Default:	= 11.39 requests per second
Percobaan 1	= 12.56 requests per second
Percobaan 2	= 10.77 requests per second
Percobaan 3	= 10.35 requests per second

Untuk menguji kinerja PHP-FM, kita bisa menyesuaikan berbagai pengaturan dalam konfigurasi PHP-FM untuk mendapatkan hasil yang paling efektif. Dari penyesuaian tersebut, percobaan pertama menunjukkan hasil terbaik dengan jumlah request per second tertinggi, sementara percobaan ketiga menunjukkan hasil terendah.

Ketika kita melakukan perubahan pada konfigurasi sistem, kita menemukan bahwa perubahannya tidak terlalu berbeda dibandingkan dengan pengaturan awal. Ini mungkin karena jumlah workload yang harus diproses oleh sistem atau karena perubahan pengaturan yang kita lakukan tidak memberikan perbedaan yang signifikan.