

Grimoire Kelompok F07 Praktikum Modul 3 Jaringan Komputer

Anggota kelompok :

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Nomor 8

Buatlah analisis hasil testing dengan 200 request dan 10 request/second masing-masing algoritma Load Balancer dengan ketentuan sebagai berikut:

- Nama Algoritma Load Balancer
- Report hasil testing pada Apache Benchmark
- Grafik request per second untuk masing masing algoritma.
- Analisis

Adapun algoritma Load Balancer yang digunakan meliputi :

- Round Robin
- Weighted Round Robin
- Least Connection
- IP Hash
- Generic Hash

A. Hasil Pengujian

1. Algoritma Round Robin

- Hasil testing Apache Benchmark

```
root@Stark:~# ab -n 200 -c 10 http://10.55.2.2/
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 10.55.2.2 (be patient)
Completed 100 requests
Completed 200 requests
Finished 200 requests


Server Software:      nginx/1.14.2
Server Hostname:      10.55.2.2
Server Port:          80

Document Path:        /
Document Length:       598 bytes

Concurrency Level:     10
Time taken for tests:   0.597 seconds
Complete requests:     200
Failed requests:        67
   (Connect: 0, Receive: 0, Length: 67, Exceptions: 0)
Total transferred:     146933 bytes
HTML transferred:      119533 bytes
Requests per second:   335.07 [#/sec] (mean)
Time per request:      29.845 [ms] (mean)
Time per request:      2.984 [ms] (mean, across all concurrent requests)
Transfer rate:         240.39 [Kbytes/sec] received

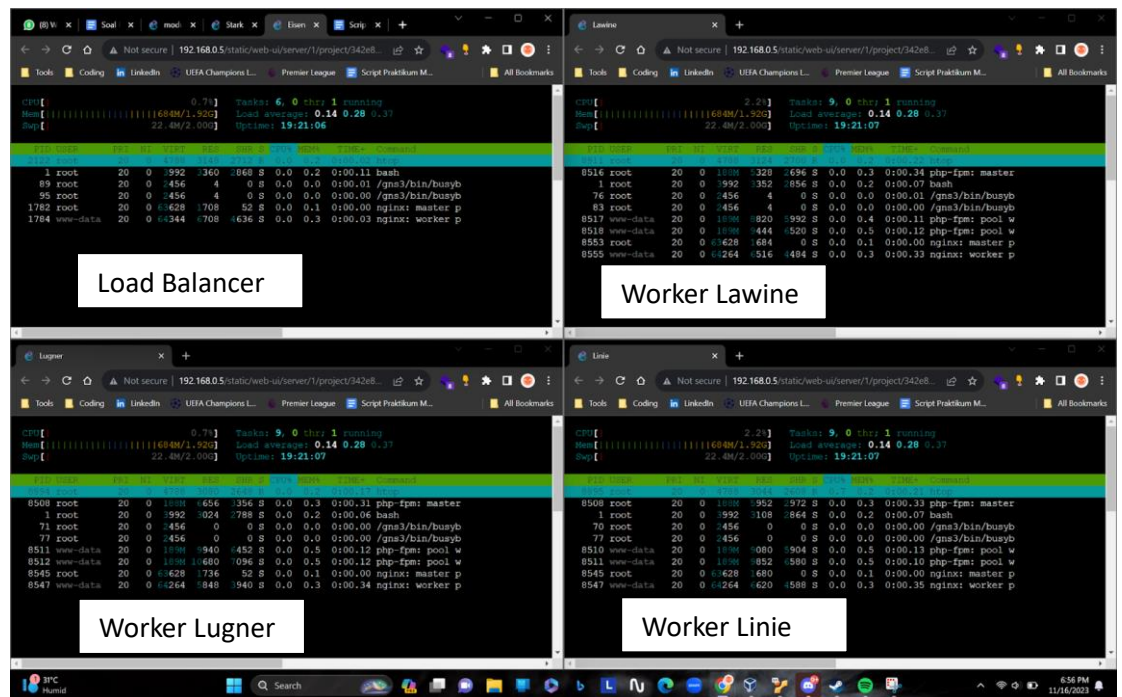

Connection Times (ms)
              min      mean[+/-sd] median    max
Connect:        1       7   2.7      6     15
Processing:     6      22   3.5     22     31
Waiting:        5      22   3.5     22     31
Total:          7      29   4.1     28     41


Percentage of the requests served within a certain time (ms)
 50%    28
 66%    31
 75%    31
 80%    32
 90%    34
 95%    37
 98%    38
 99%    40
100%    41 (longest request)
```

- Detail Worker

```
root@Lawine:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
67
root@Linie:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
67
root@Lugner:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
66
```

- Detail menggunakan Htop



2. Algoritma Weighted Round Robin

- Hasil testing Apache Benchmark

```

root@Stark:~# ab -n 200 -c 10 http://10.55.2.2/
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 10.55.2.2 (be patient)
Completed 100 requests
Completed 200 requests
Finished 200 requests

Server Software:      nginx/1.14.2
Server Hostname:      10.55.2.2
Server Port:          80

Document Path:        /
Document Length:      598 bytes

Concurrency Level:    10
Time taken for tests:  0.655 seconds
Complete requests:    200
Failed requests:       57
  (Connect: 0, Receive: 0, Length: 57, Exceptions: 0)
Total transferred:    146943 bytes
HTML transferred:     119543 bytes
Requests per second:  305.39 [#/sec] (mean)
Time per request:     32.745 [ms] (mean)
Time per request:     3.275 [ms] (mean, across all concurrent requests)
Transfer rate:        219.11 [Kbytes/sec] received

Connection Times (ms)
  min   mean[+/-sd] median   max
Connect:    2    8   4.0      7    28
Processing:  6   24   6.9     22    46
Waiting:    6   24   6.9     22    46
Total:      13   32   6.9     30    51

Percentage of the requests served within a certain time (ms)
 50%    30
 66%    33
 75%    36
 80%    37
 90%    42
 95%    44
 98%    48
 99%    50
100%    51 (longest request)

```

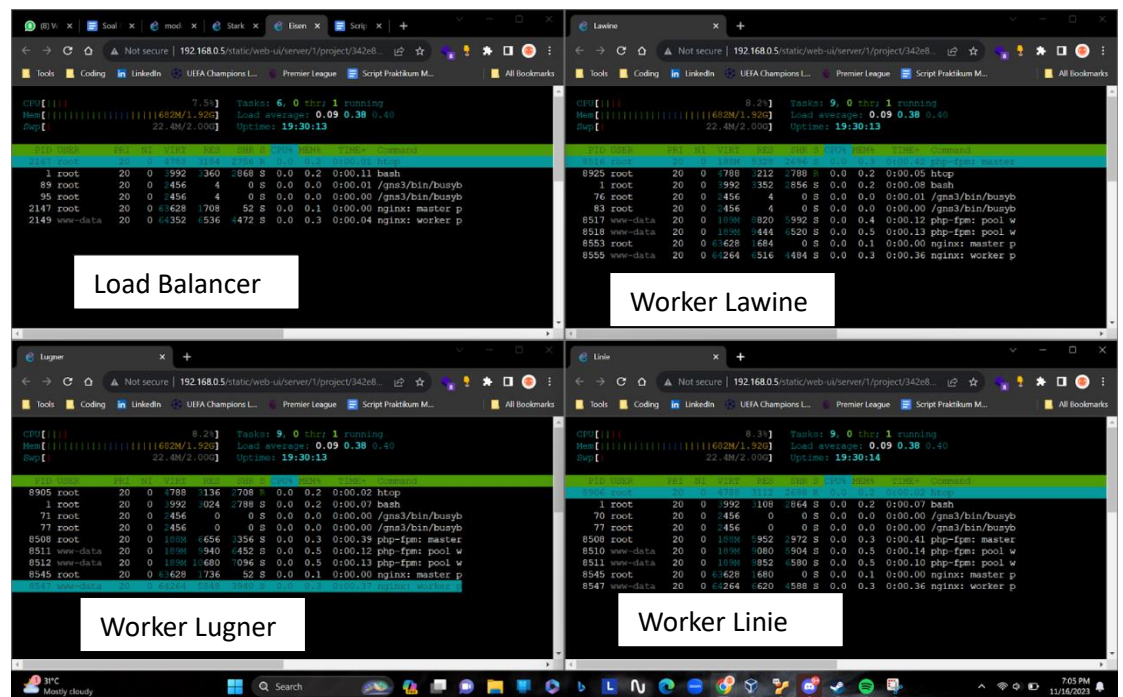
- Detail Worker

```
root@Lawine:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
114

root@Linie:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
57

root@Lugner:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
29
```

- Detail menggunakan Htop



3. Algoritma Least Connection

- Hasil testing Apache Benchmark

```
root@Stark:~# ab -n 200 -c 10 http://10.55.2.2/
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 10.55.2.2 (be patient)
Completed 100 requests
Completed 200 requests
Finished 200 requests


Server Software:      nginx/1.14.2
Server Hostname:      10.55.2.2
Server Port:          80

Document Path:        /
Document Length:      598 bytes

Concurrency Level:    10
Time taken for tests:  0.634 seconds
Complete requests:     200
Failed requests:        64
  (Connect: 0, Receive: 0, Length: 64, Exceptions: 0)
Total transferred:    146936 bytes
HTML transferred:     119536 bytes
Requests per second:  315.57 [#/sec] (mean)
Time per request:     31.689 [ms] (mean)
Time per request:     3.169 [ms] (mean, across all concurrent requests)
Transfer rate:        226.41 [Kbytes/sec] received

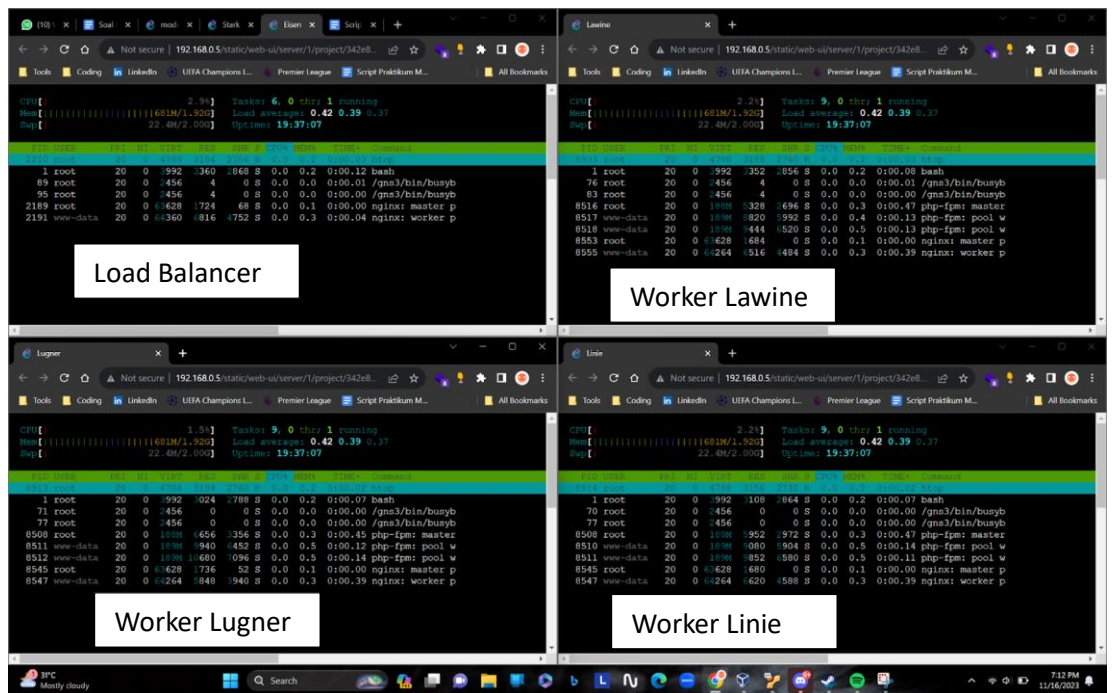

Connection Times (ms)
      min   mean[+/-sd] median   max
Connect:    0    7  2.7      7    21
Processing:  9   24  4.9     23    46
Waiting:    5   24  4.9     23    45
Total:      12   31  4.4     30    47


Percentage of the requests served within a certain time (ms)
 50%    30
 66%    32
 75%    34
 80%    35
 90%    37
 95%    38
 98%    41
 99%    45
100%    47 (longest request)
```

- Detail Worker

```
root@Lawine:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
69
root@Linie:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
64
root@Lugner:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
67
```

- Detail menggunakan Htop



4. Algoritma IP Hash

- Hasil testing Apache Benchmark

```
root@Stark:~# ab -n 200 -c 10 http://10.55.2.2/
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 10.55.2.2 (be patient)
Completed 100 requests
Completed 200 requests
Finished 200 requests


Server Software:      nginx/1.14.2
Server Hostname:      10.55.2.2
Server Port:          80

Document Path:        /
Document Length:      598 bytes

Concurrency Level:    10
Time taken for tests:  0.626 seconds
Complete requests:    200
Failed requests:       0
Total transferred:    147000 bytes
HTML transferred:     119600 bytes
Requests per second:  319.48 [#/sec] (mean)
Time per request:      31.300 [ms] (mean)
Time per request:      3.130 [ms] (mean, across all concurrent requests)
Transfer rate:         229.32 [Kbytes/sec] received

Connection Times (ms)
  min   mean[+/-sd] median   max
Connect:    0    7   3.6      7    21
Processing:  6   23   6.3     24    42
Waiting:    6   23   6.2     23    40
Total:      9   30   6.2     30    51

Percentage of the requests served within a certain time (ms)
 50%    30
 66%    32
 75%    33
 80%    34
 90%    38
 95%    42
 98%    45
 99%    47
100%    51 (longest request)
```

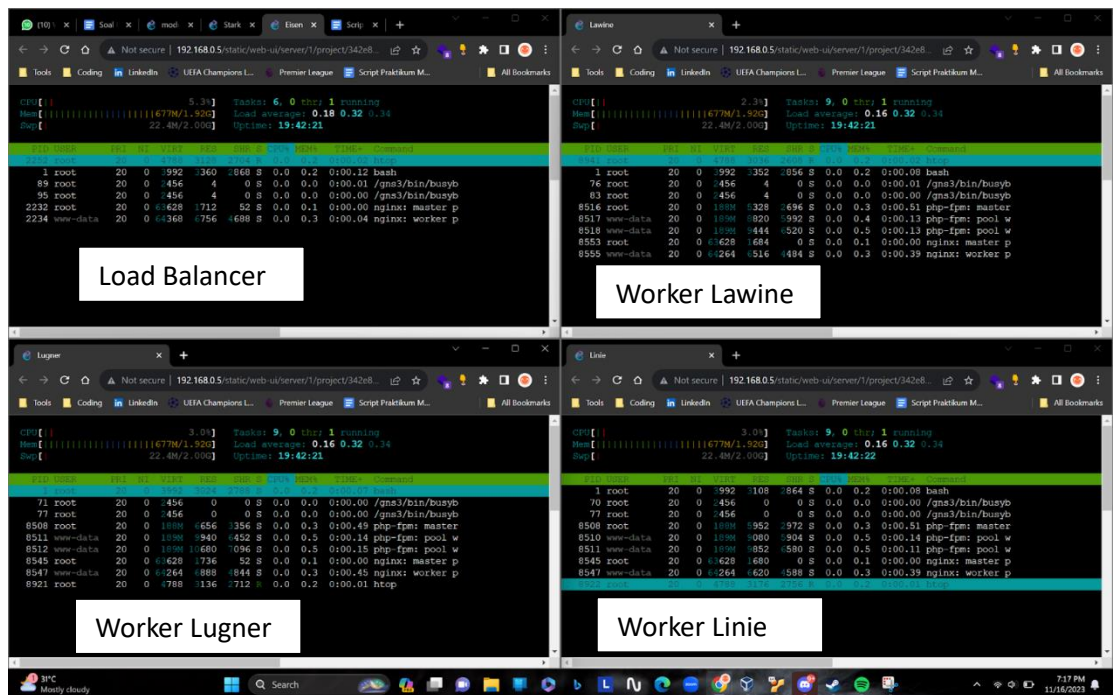
- Detail worker

```
root@Lawine:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
0

root@Linie:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
0

root@Lugner:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
200
```


- Detail menggunakan Htop



5. Algoritma Generic Hash

- Hasil testing Apache Benchmark

```
root@Stark:~# ab -n 200 -c 10 http://10.55.2.2/
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 10.55.2.2 (be patient)
Completed 100 requests
Completed 200 requests
Finished 200 requests

Server Software:      nginx/1.14.2
Server Hostname:      10.55.2.2
Server Port:          80

Document Path:        /
Document Length:      598 bytes

Concurrency Level:    10
Time taken for tests:  0.614 seconds
Complete requests:    200
Failed requests:       0
Total transferred:    147000 bytes
HTML transferred:     119600 bytes
Requests per second:  325.57 [#/sec] (mean)
Time per request:     30.716 [ms] (mean)
Time per request:     3.072 [ms] (mean, across all concurrent requests)
Transfer rate:        233.68 [Kbytes/sec] received

Connection Times (ms)
      min  mean[+/-sd] median   max
Connect:    0    7   4.3      7    29
Processing:  4   22   5.0     22   35
Waiting:    4   22   5.0     22   35
Total:       7   30   5.7     29   52

Percentage of the requests served within a certain time (ms)
 50%    29
 66%    31
 75%    32
 80%    33
 90%    37
 95%    40
 98%    46
 99%    48
100%    52 (longest request)
```

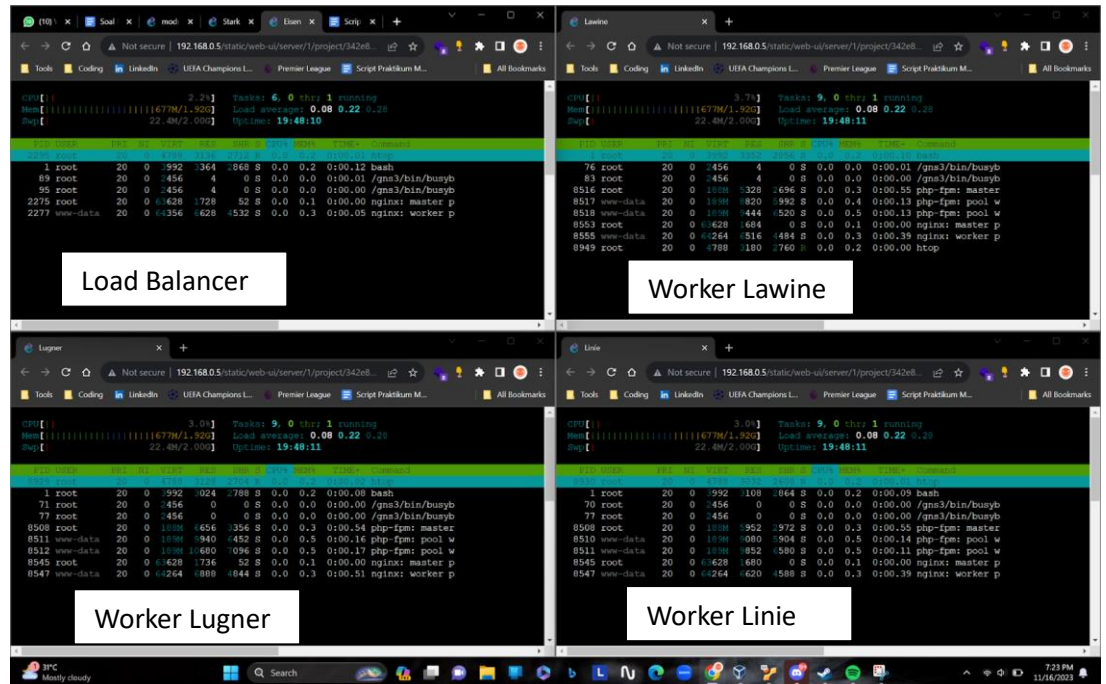

- Detail worker

```

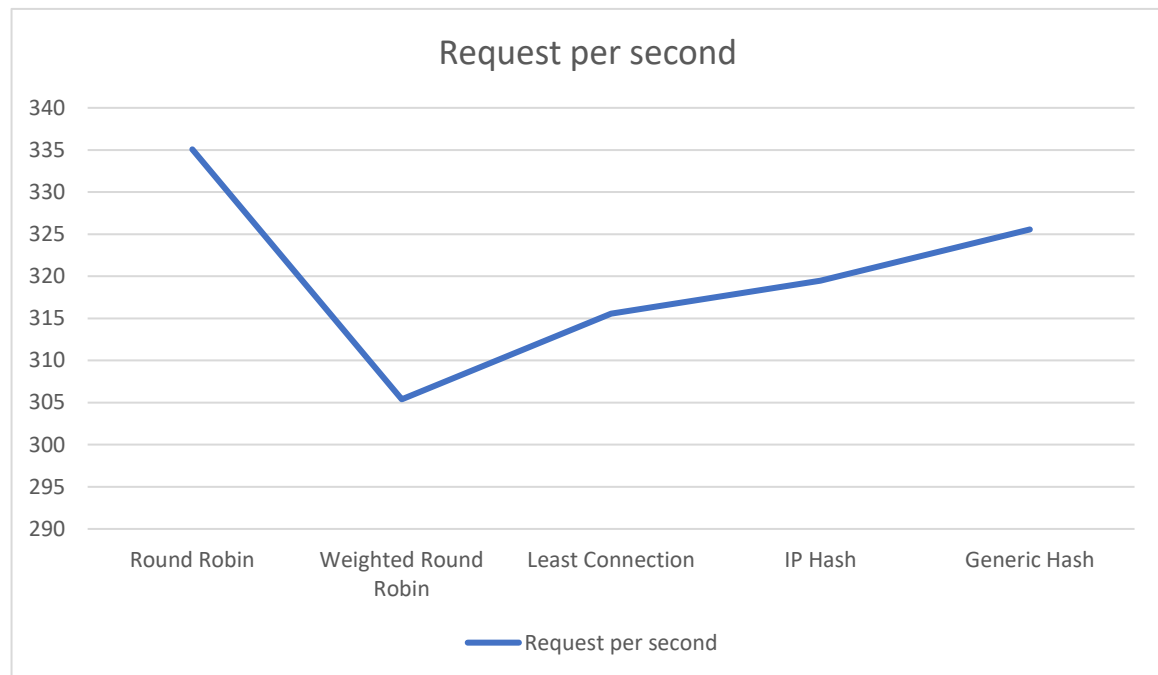
root@Lawine:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
0
root@Linie:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
0
root@Lugner:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
200

```

- Detail menggunakan Htop



B. Grafik Request Per Second



C. Analisis

Dari hasil pengujian lima algoritma Load Balancing tersebut, diperoleh hasil yang ditunjukkan pada grafik. Dapat diperhatikan bahwa algoritma Round Robin memiliki jumlah *request per second* tertinggi dibandingkan empat algoritma lainnya, yaitu sebanyak 335,07 *request per second*. Sedangkan algoritma yang paling sedikit *request per second*-nya adalah Weighted Round Robin, yaitu sebanyak 305,39. Dalam kondisi ideal, semestinya, Weighted Round Robin dapat bekerja lebih optimal dibandingkan dengan Round Robin, hal ini dikarenakan bobot kerja pada setiap worker telah dibedakan, sehingga worker dengan bobot yang lebih tinggi akan menerima lebih banyak request. Weighted Round Robin bisa mengatasi ketidakseimbangan kinerja yang terjadi pada worker. Adapun untuk Round Robin akan memberikan bobot kerja yang sama secara berurutan.

Nomor 9

Dengan menggunakan algoritma Round Robin, lakukan testing dengan menggunakan 3 worker, 2 worker, dan 1 worker sebanyak 100 request dengan 10 request/second.

A. Hasil Pengujian

1. Pengujian 3 Worker

- Hasil test Apache Benchmark

```
root@Stark:~# ab -n 100 -c 10 http://10.55.2.2/
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 10.55.2.2 (be patient).....done

Server Software:      nginx/1.14.2
Server Hostname:      10.55.2.2
Server Port:          80

Document Path:        /
Document Length:      598 bytes

Concurrency Level:    10
Time taken for tests:  0.449 seconds
Complete requests:    100
Failed requests:       33
  (Connect: 0, Receive: 0, Length: 33, Exceptions: 0)
Total transferred:    73467 bytes
HTML transferred:     59767 bytes
Requests per second:  222.76 [#/sec] (mean)
Time per request:     44.891 [ms] (mean)
Time per request:     4.489 [ms] (mean, across all concurrent requests)
Transfer rate:        159.82 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        1   11   6.2    10    36
Processing:      5   32   7.7    33    62
Waiting:        4   32   7.6    33    60
Total:          6   43   8.0    44    74

Percentage of the requests served within a certain time (ms)
 50%    44
 66%    46
 75%    47
 80%    48
 90%    51
 95%    53
 98%    59
 99%    74
100%    74 (longest request)
```

- Detail worker

```
root@Lawine:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
34
root@Linie:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
33
root@Lugner:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
33
```

-
- The screenshot displays four Docker Swarm worker nodes, each with a terminal window showing the output of the 'docker info' command. The nodes are labeled as follows:
- Load Balancer:** The terminal shows system metrics including 3.1M tasks, 9.0M memory, and 1.10 load average. It lists several containers, including '1 root', '89 root', '95 root', '2611 root', and '2613 www-data'.
 - Worker Lwaine:** The terminal shows system metrics including 2.3M tasks, 9.0M memory, and 1.10 load average. It lists several containers, including '1 root', '76 root', '83 root', '8516 root', '8517 www-data', '8518 www-data', '8553 root', and '8555 www-data'.
 - Worker Lugner:** The terminal shows system metrics including 1.5M tasks, 9.0M memory, and 1.10 load average. It lists several containers, including '1 root', '71 root', '77 root', '8508 root', '8510 www-data', '8512 www-data', '8545 root', and '8547 www-data'.
 - Worker Linie:** The terminal shows system metrics including 2.3M tasks, 9.0M memory, and 1.10 load average. It lists several containers, including '1 root', '70 root', '77 root', '8508 root', '8510 www-data', '8511 www-data', '8545 root', and '8547 www-data'.
- Each terminal window also displays the 'docker info' command output, which includes system metrics and container statistics.

2. Pengujian 2 Worker

Worker Linie di-stop

- Hasil test Apache Benchmark

```
root@Stark:~# ab -n 100 -c 10 http://10.55.2.2/
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 10.55.2.2 (be patient).....done

Server Software:      nginx/1.14.2
Server Hostname:      10.55.2.2
Server Port:          80

Document Path:        /
Document Length:      598 bytes

Concurrency Level:    10
Time taken for tests:  0.295 seconds
Complete requests:    100
Failed requests:       0
Total transferred:    73500 bytes
HTML transferred:     59800 bytes
Requests per second:  338.70 [#/sec] (mean)
Time per request:     29.525 [ms] (mean)
Time per request:     2.953 [ms] (mean, across all concurrent requests)
Transfer rate:        243.11 [Kbytes/sec] received

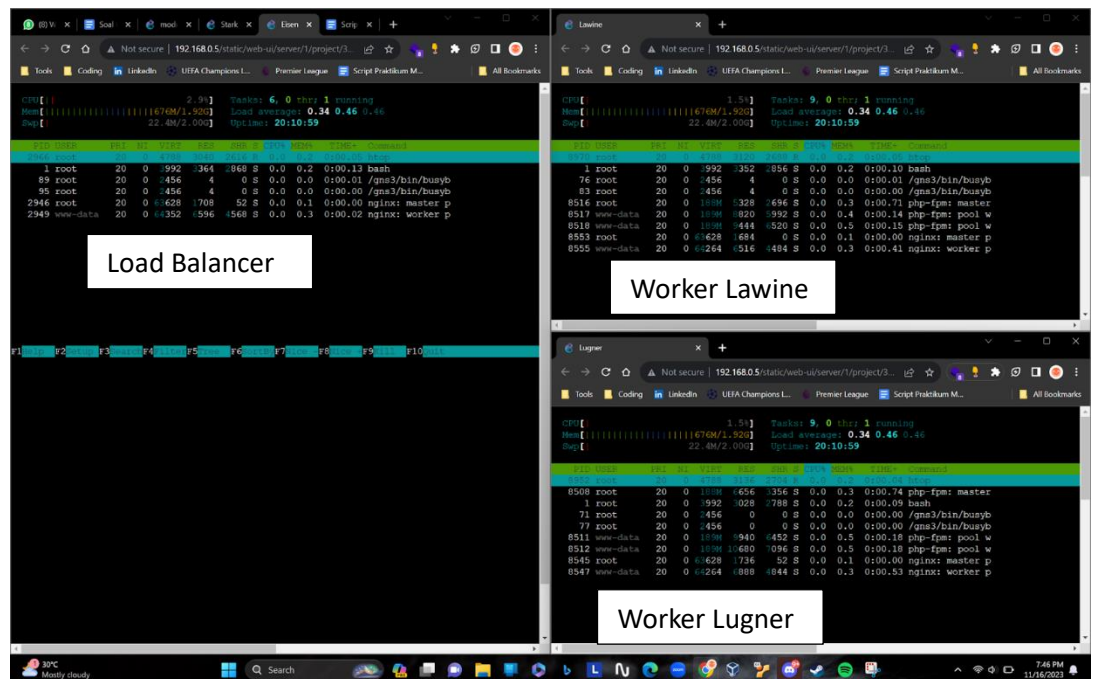
Connection Times (ms)
              min      mean[+/-sd] median   max
Connect:        1       6   3.4      6     17
Processing:     3      22   5.1     21     38
Waiting:        2      22   4.9     21     37
Total:          5      28   7.0     27     53

Percentage of the requests served within a certain time (ms)
 50%    27
 66%    29
 75%    29
 80%    29
 90%    36
 95%    47
 98%    48
 99%    53
100%    53 (longest request)
```

- Detail worker

```
root@Lawine:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
50
root@Linie:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
0
root@Lugner:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
50
```

- Detail menggunakan Htop



3. Pengujian 1 worker

Worker Linie dan Lugner di-stop

- Hasil testing Apache Benchmark

```
root@Stark:~# ab -n 100 -c 10 http://10.55.2.2/
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 10.55.2.2 (be patient).....done

Server Software:      nginx/1.14.2
Server Hostname:      10.55.2.2
Server Port:          80

Document Path:        /
Document Length:      598 bytes

Concurrency Level:    10
Time taken for tests:  0.107 seconds
Complete requests:    100
Failed requests:       0
Total transferred:    73500 bytes
HTML transferred:     59800 bytes
Requests per second:  934.06 [#/sec] (mean)
Time per request:     10.706 [ms] (mean)
Time per request:     1.071 [ms] (mean, across all concurrent requests)
Transfer rate:        670.44 [Kbytes/sec] received

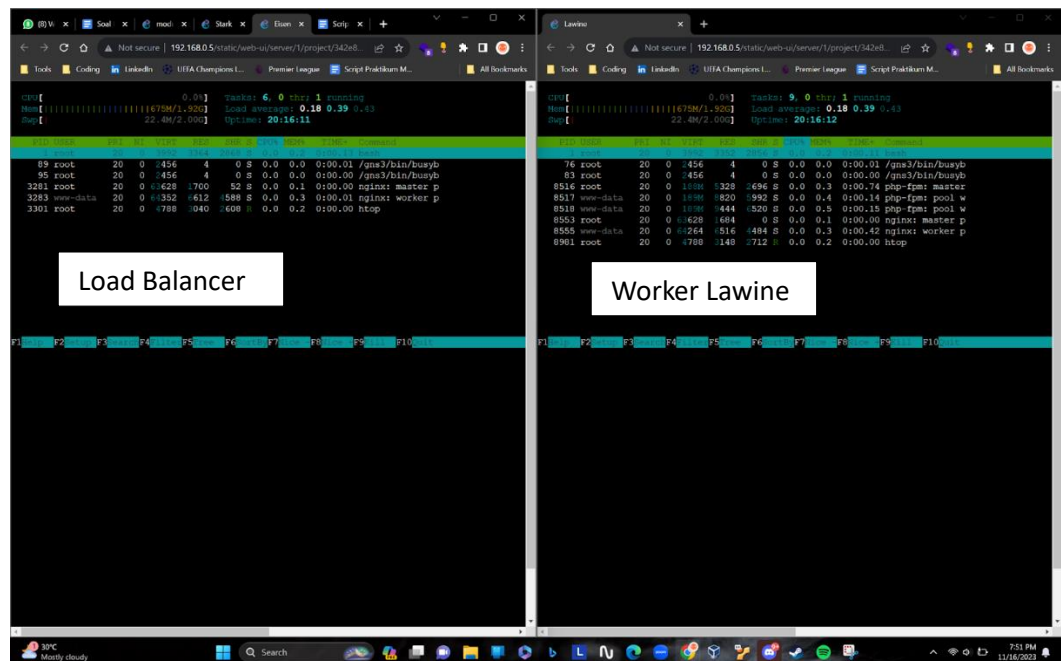
Connection Times (ms)
              min    mean[+/-sd] median    max
Connect:        0      2   1.2      2      5
Processing:     2      8   2.0      8     13
Waiting:        2      8   2.0      8     12
Total:          3     10   1.8     10     16

Percentage of the requests served within a certain time (ms)
 50%    10
 66%    11
 75%    11
 80%    11
 90%    12
 95%    14
 98%    15
 99%    16
100%    16 (longest request)
```

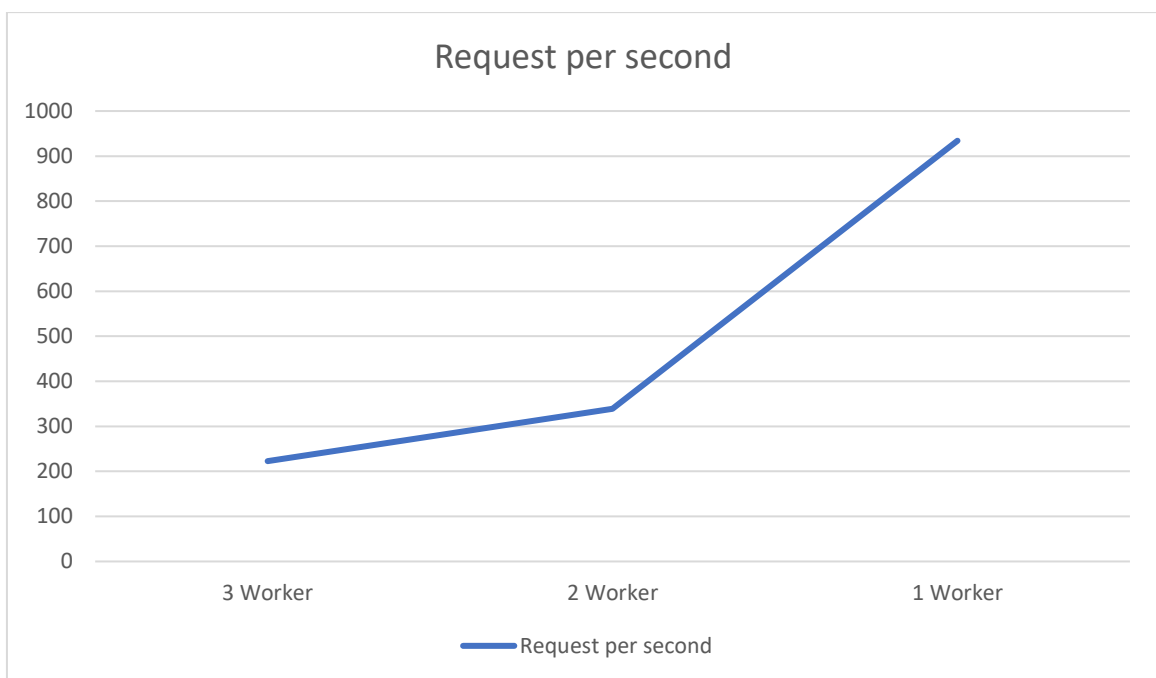
- Detail worker

```
root@Lawine:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
100
root@Linie:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
0
root@Lugner:~# cat /var/log/nginx/jarkom_access.log | grep "GET" | wc -l
0
```


- Detail menggunakan Htop



B. Grafik Request Per Second



C. Analisis

Dari hasil pengujian menggunakan algoritma Round Robin dengan jumlah worker yang berbeda diperoleh hasil dan dinyatakan dalam grafik. Dari grafik dapat dilihat bahwa semakin sedikit worker yang bekerja, maka beban kerjanya akan semakin besar. Dapat dilihat pula pada *screenshot* detail worker di setiap poin pengujian, jumlah yang ditangani oleh tiap worker

berubah-ubah, ketika masih menggunakan tiga worker, pembagiannya adalah 33-33-34, adapun ketika dua worker, pembagiannya 50-0-50, dan ketika satu worker yaitu 100-0-0. Untuk *request per second*-nya sendiri, worker yang hanya berjumlah satu memiliki *request per second* sebanyak 934,06 request setiap detiknya, sedangkan worker yang berjumlah dua memiliki *request per second* sebanyak 338,70 request setiap detiknya, dan worker yang berjumlah tiga memiliki *request per second* sebanyak 222,76 request setiap detiknya.