

BENCHMARK LOAD BALANCER
PRAKTIKUM JARINGAN KOMPUTER MODUL 3



KELOMPOK: IT25

Andyana Muhandhatul Nabila	5027211029
Andreas Timotius Parhorasan Sihombing	5027211019

Nomor 7

1000 Request dengan 100 request/sekon

a. Round robin

```
Benchmarking 10.76.2.2 (be patient)
Completed 100 requests
Completed 200 requests
Completed 300 requests
Completed 400 requests
Completed 500 requests
Completed 600 requests
Completed 700 requests
Completed 800 requests
Completed 900 requests
Completed 1000 requests
Finished 1000 requests

Server Software:      nginx/1.14.2
Server Hostname:      10.76.2.2
Server Port:          81

Document Path:        /
Document Length:      173 bytes

Concurrency Level:     100
Time taken for tests:   0.024 seconds
Complete requests:      1000
Failed requests:        0
Non-2xx responses:      1000
Keep-Alive requests:    1000
Total transferred:      330000 bytes
HTML transferred:       173000 bytes
Requests per second:    41267.75 [#/sec] (mean)
Time per request:       2.423 [ms] (mean)
Time per request:       0.024 [ms] (mean, across all concurrent requests)
Transfer rate:          13299.18 [Kbytes/sec] received

Connection Times (ms)
      min  mean[+/-sd] median  max
Connect:    0      0  0.8      0    4
Processing:  0      2  1.2      2    6
Waiting:    0      2  1.2      2    5
Total:      0      2  1.6      2    7

Percentage of the requests served within a certain time (ms)
 50%      2
 66%      2
 75%      2
 80%      2
 90%      5
 95%      5
 98%      7
 99%      7
100%      7 (longest request)
root@Elsen:~#
```

b. Least Connection

```
Benchmarking 10.76.2.2 (be patient)
Completed 100 requests
Completed 200 requests
Completed 300 requests
Completed 400 requests
Completed 500 requests
Completed 600 requests
Completed 700 requests
Completed 800 requests
Completed 900 requests
Completed 1000 requests
Finished 1000 requests

Server Software:      nginx/1.14.2
Server Hostname:      10.76.2.2
Server Port:          82

Document Path:        /
Document Length:      173 bytes

Concurrency Level:    100
Time taken for tests:  0.031 seconds
Complete requests:    1000
Failed requests:      0
Non-2xx responses:    1000
Keep-Alive requests:  1000
Total transferred:    330000 bytes
HTML transferred:    173000 bytes
Requests per second:  32005.12 [#/sec] (mean)
Time per request:     3.124 [ms] (mean)
Time per request:     0.031 [ms] (mean, across all concurrent requests)
Transfer rate:        10314.15 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median  max
Connect:      0    0   0.7      0    4
Processing:   1    2   1.1      2    6
Waiting:      1    2   1.1      2    6
Total:        1    3   1.3      2    7

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

c. IP Hash

```
Benchmarking 10.76.2.2 (be patient)
Completed 100 requests
Completed 200 requests
Completed 300 requests
Completed 400 requests
Completed 500 requests
Completed 600 requests
Completed 700 requests
Completed 800 requests
Completed 900 requests
Completed 1000 requests
Finished 1000 requests

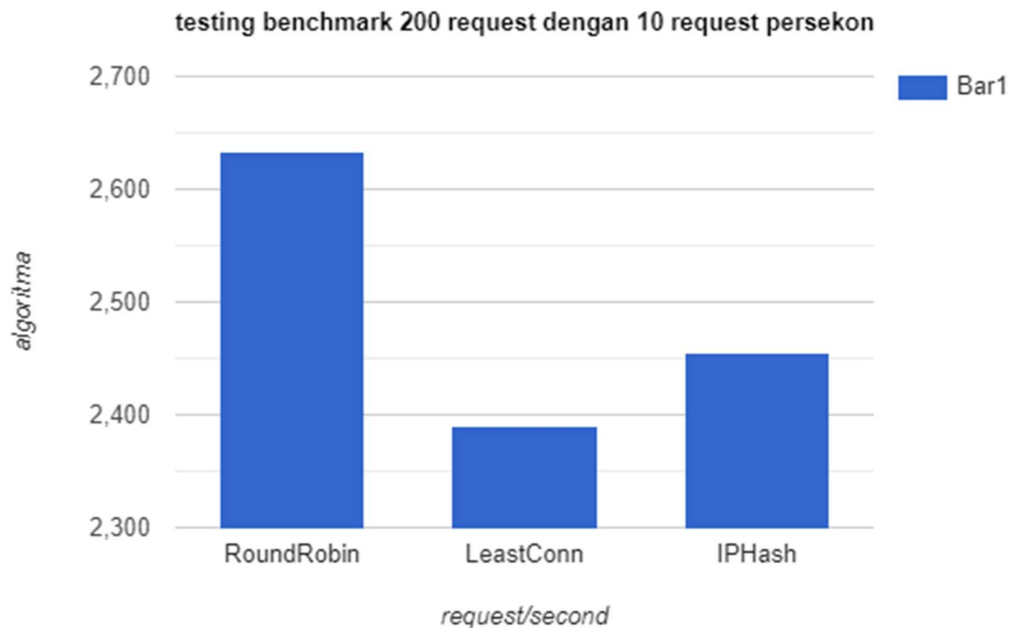
Server Software:      nginx/1.14.2
Server Hostname:      10.76.2.2
Server Port:          83

Document Path:        /
Document Length:      173 bytes

Concurrency Level:    100
Time taken for tests:  0.027 seconds
Complete requests:    1000
Failed requests:       0
Non-2xx responses:    1000
Keep-Alive requests:  1000
Total transferred:    330000 bytes
HTML transferred:     173000 bytes
Requests per second:  36983.62 [#/sec] (mean)
Time per request:     2.704 [ms] (mean)
Time per request:     0.027 [ms] (mean, across all concurrent requests)
Transfer rate:        11918.55 [Kbytes/sec] received

Connection Times (ms)
              min    mean[+/-sd] median    max
Connect:        0      0   0.9      0      5
Processing:      0      2   1.5      2      7
Waiting:        0      2   1.4      2      6
Total:          0      2   1.7      2      7

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



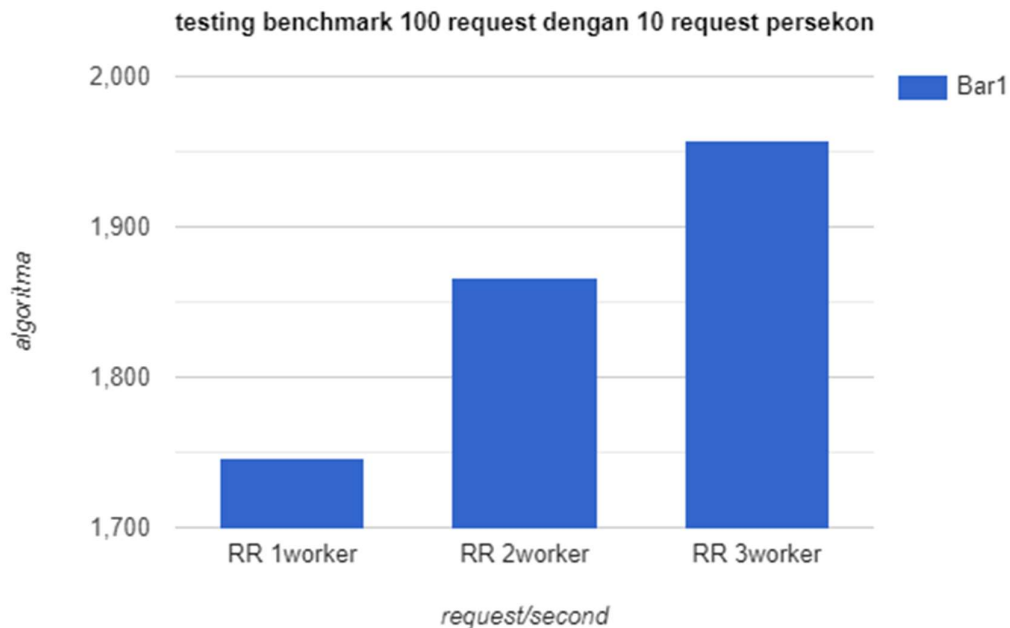
Grafik yang diatas menunjukkan hasil benchmark tiga algoritma load balancing, antara algoritma Round Robin, Least Connection, dan IP Hash. benchmark dilakukan dengan mengirimkan 200 request dengan interval 10 requests per detik.

Dari grafik diatas dapat dilihat bahwa:

1. Round Robin memiliki rata-rata waktu respons tertinggi, yaitu sekitar 2,7 detik.
2. Least Connection memiliki rata-rata waktu respons terendah, yaitu sekitar 2,3 detik.
3. IP Hash memiliki rata-rata waktu respons yaitu sekitar 2,5 detik.

Kesimpulan:

Berdasarkan hasil benchmark dapat disimpulkan bahwa algoritma Least Connection adalah algoritma load balancing yang paling optimal dalam hal waktu respons. Dari literatur yang ada algoritma ini bekerja dengan cara memilih server dengan jumlah koneksi aktif paling sedikit untuk setiap request. Sehingga ini menyebabkan beban kerja dapat didistribusikan secara lebih merata, sehingga waktu respons menjadi lebih cepat.



Dari grafik diatas menunjukkan hasil benchmark pada algoritma load balancer Round Robin dengan 1 worker, 2 workers dan 3 workers. Benchmark dilakukan dengan mengirimkan 100 request dengan interval 10 requests per detik.

Dari grafik diatas dapat dilihat bahwa:

1. Dengan jumlah worker 1, load balancer hanya dapat menangani sekitar 1.700 request per detik.
2. Dengan jumlah worker 2, load balancer dapat menangani sekitar 1.900 request per detik.
3. Dengan jumlah worker 3, load balancer dapat menangani sekitar 2.000 request per detik.

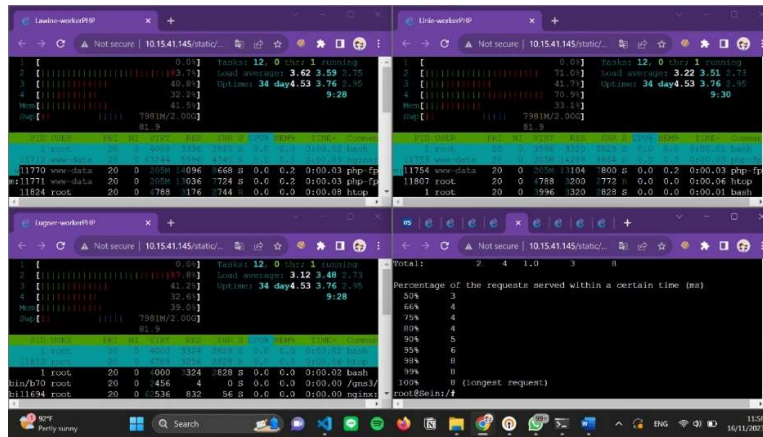
Peningkatan kapasitas load balancer tidak linear. Peningkatan kapasitas dari jumlah worker 1 ke 2 lebih besar daripada peningkatan kapasitas dari jumlah worker 2 ke 3. Hal ini karena load balancer memiliki overhead untuk mengelola worker-workernya.

Kesimpulan:

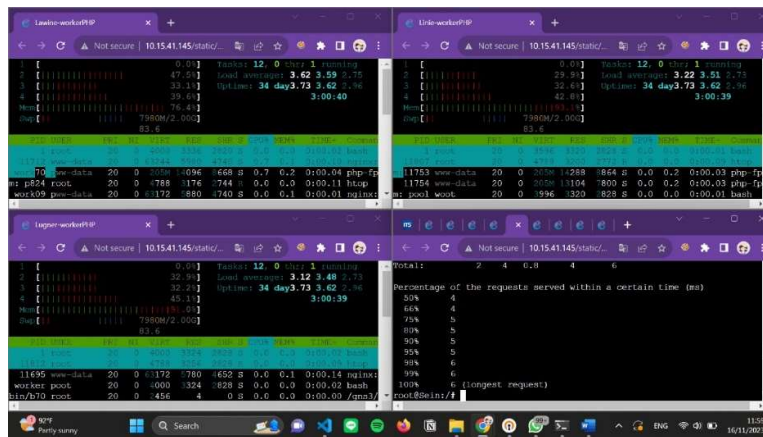
Berdasarkan hasil benchamark yang diminta pada modul ini dapat disimpulkan bahwa jika jumlah worker yang lebih banyak akan meningkatkan kapasitas load balancer. Namun, perlu dipertimbangkan bahwa peningkatan kapasitas tidak linear dan ada overhead yang harus ditanggung oleh load balancer.

Testing menggunakan 200 request dan 10 request/second

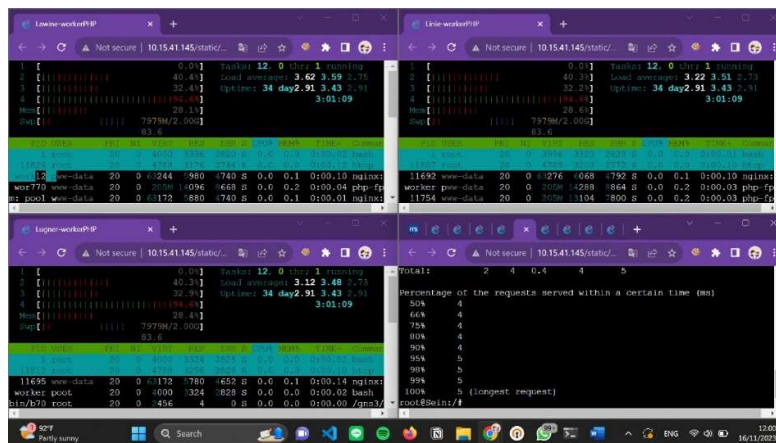
a. Roundrobin



b. Least Connection

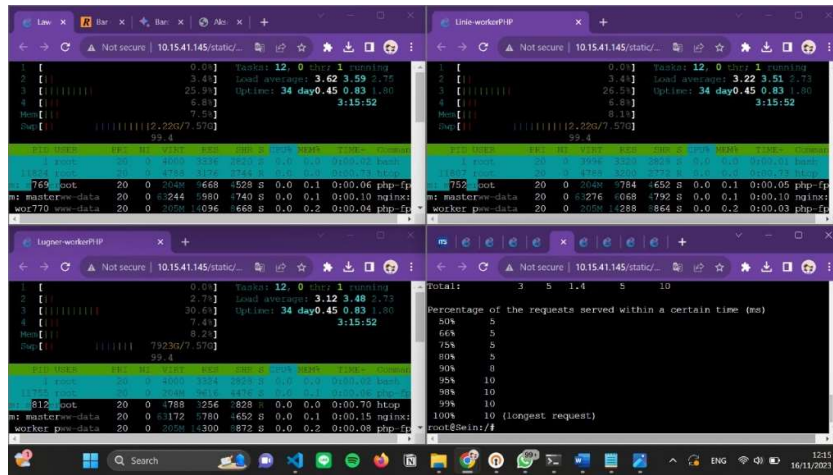


c. IP hash

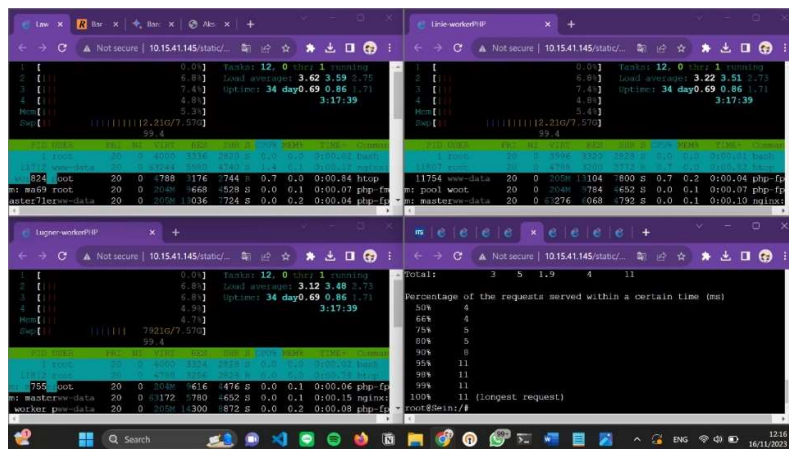


Testing dengan 100 request dan 10 request/second

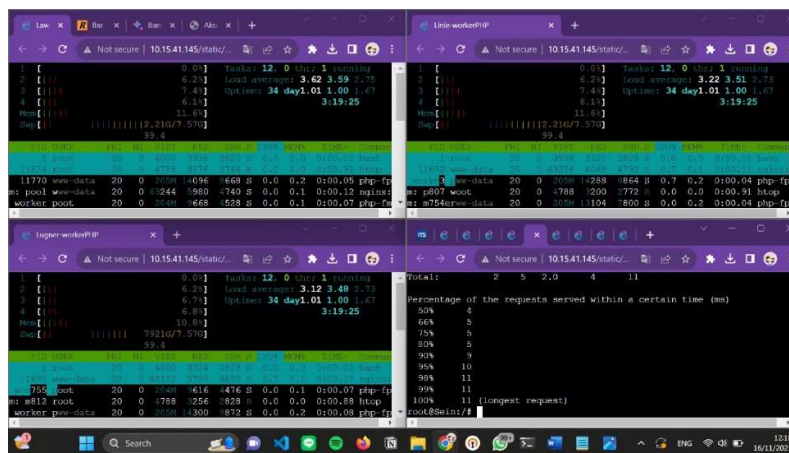
a. Round Robin 1 worker



b. Round robin 2 worker



c. Round robin 3 worker




```

Server Software:      nginx/1.14.2
Server Hostname:      10.76.4.1
Server Port:          8000

Document Path:        /api/auth/register
Document Length:      469 bytes

Concurrency Level:    10
Time taken for tests:  0.688 seconds
Complete requests:    100
Failed requests:      99
    (Connect: 0, Receive: 0, Length: 99, Exceptions: 0)
Non-2xx responses:    99
Total transferred:    266599 bytes
Total body sent:      21800
HTML transferred:     235526 bytes
Requests per second:  145.31 [#/sec] (mean)
Time per request:     68.820 [ms] (mean)
Time per request:     6.882 [ms] (mean, across all concurrent requests)
Transfer rate:        378.31 [Kbytes/sec] received
                      30.93 kb/s sent
                      409.24 kb/s total

```

Karena register itu tidak boleh sama usernamenya sehingga sisanya gagal karena hanya daftar 1 kali jika request 100 maka 1 berhasil 99 gagal

```

Server Software:      nginx/1.14.2
Server Hostname:      10.76.4.2
Server Port:          8000

Document Path:        /api/auth/login
Document Length:      31 bytes

Concurrency Level:    10
Time taken for tests:  0.946 seconds
Complete requests:    100
Failed requests:      36
    (Connect: 0, Receive: 0, Length: 36, Exceptions: 0)
Non-2xx responses:    100
Total transferred:    264781 bytes
Total body sent:      21300
HTML transferred:     233649 bytes
Requests per second:  105.68 [#/sec] (mean)
Time per request:     94.623 [ms] (mean)
Time per request:     9.462 [ms] (mean, across all concurrent requests)
Transfer rate:        273.27 [Kbytes/sec] received
                      21.98 kb/s sent
                      295.25 kb/s total

```

Ini untuk login, terjadi failed karena hanya menggunakan 1 worker kurang efektif untuk handle 100 request

```

Server Software:      nginx/1.14.2
Server Hostname:      10.76.4.3
Server Port:          8000

Document Path:        /api/me
Document Length:      42 bytes

Concurrency Level:    10
Time taken for tests:  0.344 seconds
Complete requests:    100
Failed requests:      40
    (Connect: 0, Receive: 0, Length: 40, Exceptions: 0)
Non-2xx responses:    100
Total transferred:    298630 bytes
HTML transferred:     267280 bytes
Requests per second:  290.34 [#/sec] (mean)
Time per request:     34.443 [ms] (mean)
Time per request:     3.444 [ms] (mean, across all concurrent requests)
Transfer rate:        846.71 [Kbytes/sec] received

```

Gagalnya karena hanya 1 worker dan tidak mampu handle requestnya kurang efektif