

Kelompok E27

Rachman Ridwan 5025201061

Akmal Nafis 5025211216

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

- a. Nama Algoritma Load Balancer

Round Robin

The image displays three terminal windows showing system resource usage and process lists. The top two windows show the initial state, and the bottom window shows the state after a load test.

Terminal 1 (Top Left):

```
CPU: 1.5% Tasks: 9, 0 thr: 1 running
Mem: 677M/1.92G Load average: 0.38 0.25 0.26
Swap: 2.57M/2.00G Uptime: 02:15:45
```

PID	USER	PR	NI	VI	RT	RES	SHR	S	CPU%	MEM%	TIME+	Command
205	root	20	0	4788	3076	2648	R	0.0	0.2	0.00	0.09	htop
154	root	20	0	217M	10524	5412	S	0.0	0.5	0.00	0.90	php-fpm: master
1	root	20	0	3992	3344	2860	S	0.0	0.2	0.00	0.06	bash
69	root	20	0	2456	4	0	S	0.0	0.0	0.00	0.02	/gnss3/bin/busy
76	root	20	0	2456	4	0	S	0.0	0.0	0.00	0.00	/gnss3/bin/busy
155	www-data	20	0	218M	10476	5340	S	0.0	0.5	0.00	0.00	php-fpm: pool w
156	www-data	20	0	218M	10476	5340	S	0.0	0.5	0.00	0.00	php-fpm: pool w
185	root	20	0	61592	1736	52	S	0.0	0.1	0.00	0.00	nginx: master p
187	www-data	20	0	62228	5640	3728	S	0.0	0.3	0.00	0.00	nginx: worker p

Terminal 2 (Top Right):

```
CPU: 1.5% Tasks: 9, 0 thr: 1 running
Mem: 677M/1.92G Load average: 0.38 0.25 0.26
Swap: 2.57M/2.00G Uptime: 02:15:46
```

PID	USER	PR	NI	VI	RT	RES	SHR	S	CPU%	MEM%	TIME+	Command
206	root	20	0	4788	3156	2728	R	0.0	0.2	0.00	0.14	htop
155	root	20	0	217M	10536	5424	S	0.0	0.5	0.00	0.86	php-fpm: master
1	root	20	0	3992	3296	2792	S	0.0	0.2	0.00	0.06	bash
71	root	20	0	2456	4	0	S	0.0	0.0	0.00	0.01	/gnss3/bin/busy
77	root	20	0	2456	4	0	S	0.0	0.0	0.00	0.00	/gnss3/bin/busy
156	www-data	20	0	218M	10488	5352	S	0.0	0.5	0.00	0.00	php-fpm: pool w
157	www-data	20	0	218M	10488	5352	S	0.0	0.5	0.00	0.00	php-fpm: pool w
186	root	20	0	61592	1736	52	S	0.0	0.1	0.00	0.00	nginx: master p
188	www-data	20	0	62228	5664	3756	S	0.0	0.3	0.00	0.00	nginx: worker p

Terminal 3 (Bottom):

```
CPU: 1.5% Tasks: 10, 0 thr: 1 running
Mem: 677M/1.92G Load average: 0.38 0.25 0.26
Swap: 2.57M/2.00G Uptime: 02:15:46
```

PID	USER	PR	NI	VI	RT	RES	SHR	S	CPU%	MEM%	TIME+	Command
155	root	20	0	217M	10100	5208	S	0.0	0.5	0.00	0.37	php-fpm: master
512	root	20	0	4788	3184	2756	R	0.0	0.2	0.00	0.09	htop
1	root	20	0	3996	3200	2708	S	0.0	0.2	0.00	0.05	bash
71	root	20	0	2456	4	0	S	0.0	0.0	0.00	0.01	/gnss3/bin/busy
77	root	20	0	2456	4	0	S	0.0	0.0	0.00	0.00	/gnss3/bin/busy
156	www-data	20	0	218M	14520	9312	S	0.0	0.7	0.00	0.10	php-fpm: pool w
157	www-data	20	0	218M	13076	7968	S	0.0	0.7	0.00	0.10	php-fpm: pool w
188	root	20	0	61592	1732	52	S	0.0	0.1	0.00	0.00	nginx: master p
190	www-data	20	0	62300	6780	4692	S	0.0	0.3	0.00	0.35	nginx: worker p
220	www-data	20	0	218M	13548	8472	S	0.0	0.7	0.00	0.06	php-fpm: pool w

IP hash

The image displays three terminal windows showing system resource usage and process lists. The top two windows show the initial state, and the bottom window shows the state after a load test.

Terminal 1 (Top Left):

```
CPU: 2.3% Tasks: 9, 0 thr: 1 running
Mem: 677M/1.92G Load average: 0.23 0.67 0.50
Swap: 2.57M/2.00G Uptime: 02:22:54
```

PID	USER	PR	NI	VI	RT	RES	SHR	S	CPU%	MEM%	TIME+	Command
205	root	20	0	4788	3076	2648	R	0.0	0.2	0.00	0.09	htop
154	root	20	0	217M	10524	5412	S	0.0	0.5	0.00	0.98	php-fpm: master
1	root	20	0	3992	3344	2860	S	0.0	0.2	0.00	0.06	bash
69	root	20	0	2456	4	0	S	0.0	0.0	0.00	0.02	/gnss3/bin/busy
76	root	20	0	2456	4	0	S	0.0	0.0	0.00	0.00	/gnss3/bin/busy
155	www-data	20	0	218M	10476	5340	S	0.0	0.5	0.00	0.00	php-fpm: pool w
156	www-data	20	0	218M	10476	5340	S	0.0	0.5	0.00	0.00	php-fpm: pool w
185	root	20	0	61592	1736	52	S	0.0	0.1	0.00	0.00	nginx: master p
187	www-data	20	0	62228	5640	3728	S	0.0	0.3	0.00	0.00	nginx: worker p

Terminal 2 (Top Right):

```
CPU: 1.5% Tasks: 9, 0 thr: 1 running
Mem: 677M/1.92G Load average: 0.23 0.67 0.50
Swap: 2.57M/2.00G Uptime: 02:22:55
```

PID	USER	PR	NI	VI	RT	RES	SHR	S	CPU%	MEM%	TIME+	Command
155	root	20	0	217M	10536	5424	S	0.0	0.5	0.00	0.93	php-fpm: master
1	root	20	0	3992	3296	2792	S	0.0	0.2	0.00	0.06	bash
71	root	20	0	2456	4	0	S	0.0	0.0	0.00	0.01	/gnss3/bin/busy
77	root	20	0	2456	4	0	S	0.0	0.0	0.00	0.00	/gnss3/bin/busy
156	www-data	20	0	218M	10488	5352	S	0.0	0.5	0.00	0.00	php-fpm: pool w
157	www-data	20	0	218M	10488	5352	S	0.0	0.5	0.00	0.00	php-fpm: pool w
186	root	20	0	61592	1736	52	S	0.0	0.1	0.00	0.00	nginx: master p
188	www-data	20	0	62228	5664	3756	S	0.0	0.3	0.00	0.00	nginx: worker p

Terminal 3 (Bottom):

```
CPU: 0.0% Tasks: 10, 0 thr: 1 running
Mem: 677M/1.92G Load average: 0.23 0.67 0.50
Swap: 2.57M/2.00G Uptime: 02:22:54
```

PID	USER	PR	NI	VI	RT	RES	SHR	S	CPU%	MEM%	TIME+	Command
512	root	20	0	4788	3184	2756	R	0.0	0.2	0.00	0.37	htop
155	root	20	0	217M	10100	5208	S	0.0	0.5	0.00	0.94	php-fpm: master
190	www-data	20	0	62300	6780	4692	S	0.0	0.3	0.00	0.39	nginx: worker p
156	www-data	20	0	218M	14520	9312	S	0.0	0.7	0.00	0.12	php-fpm: pool w
220	www-data	20	0	218M	13548	8472	S	0.0	0.7	0.00	0.07	php-fpm: pool w
1	root	20	0	3996	3200	2708	S	0.0	0.2	0.00	0.05	bash
71	root	20	0	2456	4	0	S	0.0	0.0	0.00	0.01	/gnss3/bin/busy
77	root	20	0	2456	4	0	S	0.0	0.0	0.00	0.00	/gnss3/bin/busy
157	www-data	20	0	218M	13076	7968	S	0.0	0.7	0.00	0.10	php-fpm: pool w
188	root	20	0	61592	1732	52	S	0.0	0.1	0.00	0.00	nginx: master p

Least Connect

The image displays three terminal windows showing system resource usage and process lists. The top-left window shows the Least Connect load balancer configuration. The top-right window shows the Round Robin load balancer configuration. The bottom window shows the Weighted Round Robin load balancer configuration. Each window displays CPU usage, memory usage, swap usage, and a list of processes with their respective resource usage and commands.

```
CPU [|||||] 10.1% Tasks: 9, 0 thr: 1 running
Mem [|||||] 677M/1.92G Load average: 0.02 0.36 0.42
Swap [|||||] 2.57M/2.00G Uptime: 02:27:35

PID USER PR1 NI VIRT RES SHR S CPU% MEM% TIME+ Command
205 root 20 0 4788 3076 2648 S 0.0 0.2 0:00.57 httpd
154 root 20 0 217M 10524 5412 S 0.0 0.5 0:01.02 php-fpm: master
1 root 20 0 3992 3344 2860 S 0.0 0.2 0:00.06 bash
69 root 20 0 2456 4 0 S 0.0 0.0 0:00.02 /gn3/bin/busyb
76 root 20 0 2456 4 0 S 0.0 0.0 0:00.00 /gn3/bin/busyb
155 www-data 20 0 218M 10476 5340 S 0.0 0.5 0:00.00 php-fpm: pool w
156 www-data 20 0 218M 10476 5340 S 0.0 0.5 0:00.00 php-fpm: pool w
185 root 20 0 61592 1736 52 S 0.0 0.1 0:00.00 nginx: master p
187 www-data 20 0 62228 5640 3728 S 0.0 0.3 0:00.00 nginx: worker p
```

```
CPU [|||||] 4.5% Tasks: 9, 0 thr: 1 running
Mem [|||||] 677M/1.92G Load average: 0.02 0.36 0.42
Swap [|||||] 2.57M/2.00G Uptime: 02:27:36

PID USER PR1 NI VIRT RES SHR S CPU% MEM% TIME+ Command
206 root 20 0 4788 3156 2728 R 0.0 0.2 0:00.61 httpd
155 root 20 0 217M 10536 5424 S 0.0 0.5 0:00.98 php-fpm: master
1 root 20 0 3992 3296 2792 S 0.0 0.2 0:00.06 bash
71 root 20 0 2456 4 0 S 0.0 0.0 0:00.01 /gn3/bin/busyb
77 root 20 0 2456 4 0 S 0.0 0.0 0:00.00 /gn3/bin/busyb
156 www-data 20 0 218M 10488 5352 S 0.0 0.5 0:00.00 php-fpm: pool w
157 www-data 20 0 218M 10488 5352 S 0.0 0.5 0:00.00 php-fpm: pool w
186 root 20 0 61592 1736 52 S 0.0 0.1 0:00.00 nginx: master p
188 www-data 20 0 62228 5664 3756 S 0.0 0.3 0:00.00 nginx: worker p
```

```
CPU [|||||] 9.3% Tasks: 10, 0 thr: 1 running
Mem [|||||] 677M/1.92G Load average: 0.02 0.36 0.42
Swap [|||||] 2.57M/2.00G Uptime: 02:27:35

PID USER PR1 NI VIRT RES SHR S CPU% MEM% TIME+ Command
512 root 20 0 4788 3184 2756 R 0.0 0.2 0:00.58 httpd
155 root 20 0 217M 10100 5200 S 0.0 0.5 0:00.98 php-fpm: master
190 www-data 20 0 63300 6780 4692 S 0.0 0.3 0:00.45 nginx: worker p
220 www-data 20 0 218M 13548 8472 S 0.0 0.7 0:00.09 php-fpm: pool w
157 www-data 20 0 218M 13076 7968 S 0.0 0.7 0:00.12 php-fpm: pool w
156 www-data 20 0 218M 14520 9312 S 0.0 0.7 0:00.13 php-fpm: pool w
1 root 20 0 3996 3200 2708 S 0.0 0.2 0:00.05 bash
71 root 20 0 2456 4 0 S 0.0 0.0 0:00.01 /gn3/bin/busyb
77 root 20 0 2456 4 0 S 0.0 0.0 0:00.00 /gn3/bin/busyb
188 root 20 0 61592 1732 52 S 0.0 0.1 0:00.00 nginx: master p
```

b. Report hasil testing pada Apache Benchmark

- Round Robin

```
Connection Times (ms)
              min      mean[+/-sd] median   max
Connect:      0        3    2.6      2     12
Processing:    2        8    3.3      8     17
Waiting:       2        8    3.3      8     17
Total:         4       11    2.7     11     18

Percentage of the requests served within a certain time (ms)
 50%    11
 66%    12
 75%    13
 80%    13
 90%    15
 95%    16
 98%    17
 99%    18
100%    18 (longest request)
root@Revolte:/#
```

- IP Hash

```
Completed 100 requests
Completed 200 requests
Finished 200 requests

Server Software:      nginx/1.14.2
Server Hostname:      www.granz.channel.e27.com
Server Port:          80

Document Path:        /
Document Length:       625 bytes

Concurrency Level:     10
Time taken for tests:   0.250 seconds
Complete requests:     200
Failed requests:        0
Total transferred:     152400 bytes
HTML transferred:      125000 bytes
Requests per second:   799.17 [#/sec] (mean)
Time per request:       12.513 [ms] (mean)
Time per request:       1.251 [ms] (mean, across all concurrent requests)
Transfer rate:          594.69 [Kbytes/sec] received

Connection Times (ms)
              min    mean[+/-sd] median   max
Connect:        0      4   3.3      4    13
Processing:      1      8   2.8      8    15
Waiting:         1      8   2.8      8    14
Total:           1     12   3.1     12    20

Percentage of the requests served within a certain time (ms)
 50%    12
 66%    13
 75%    14
 80%    15
 90%    17
 95%    18
 98%    19
 99%    19
100%    20 (longest request)
```

- Least Connect

```
Completed 100 requests
Completed 200 requests
Finished 200 requests

Server Software:      nginx/1.14.2
Server Hostname:      www.granz.channel.e27.com
Server Port:          80

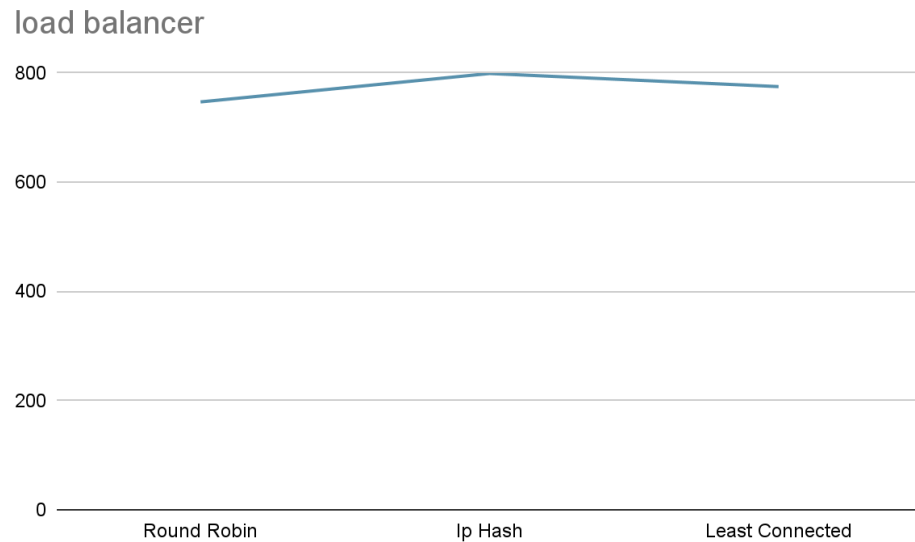
Document Path:        /
Document Length:       625 bytes

Concurrency Level:     10
Time taken for tests:   0.258 seconds
Complete requests:     200
Failed requests:        0
Total transferred:     152400 bytes
HTML transferred:      125000 bytes
Requests per second:   775.89 [#/sec] (mean)
Time per request:       12.889 [ms] (mean)
Time per request:       1.289 [ms] (mean, across all concurrent requests)
Transfer rate:          577.37 [Kbytes/sec] received

Connection Times (ms)
              min    mean[+/-sd] median   max
Connect:        0      4   2.5      3    11
Processing:      1      9   3.4      8    19
Waiting:         1      8   3.4      8    19
Total:           4     12   3.3     12    19

Percentage of the requests served within a certain time (ms)
 50%    12
 66%    13
 75%    14
 80%    15
 90%    17
 95%    19
 98%    19
 99%    19
100%    19 (longest request)
root@revolte:~#
```

c. Grafik request per second untuk masing masing algoritma.



d. Analisis

Aplikasi loadbalancing digunakan dalam kasus yang spesifik, menurut hasil bechmark yang telah kami lakukan dengan dengan 200 request dan 10 request/second. Algoritma Round robin dapat membagi beban secara merata untuk tiap-tiap worker meskipun memiliki throughput yang paling rendah. Sedangkan pada algoritma IP hash memiliki request per second paling tinggi dan paling stabil dilihat dari berchmarknya. Untuk Algoritma Least connected dalam transfer rate dan request per secondnya masih lebih kecil daripada IP hash namun bisa dilihat memiliki beban server yang begitu besar

4. Dengan menggunakan algoritma Round Robin, lakukan testing dengan menggunakan 3 worker, 2 worker, dan 1 worker sebanyak 100 request dengan 10 request/second, kemudian tambahkan grafiknya pada grimoire.

- 3 worker

```
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Benchmarking www.granz.channel.e27.com (be patient).....done

Server Software:      nginx/1.14.2
Server Hostname:      www.granz.channel.e27.com
Server Port:          80

Document Path:        /
Document Length:      625 bytes

Concurrency Level:    10
Time taken for tests:  0.111 seconds
Complete requests:    100
Failed requests:      0
Total transferred:    76200 bytes
HTML transferred:     62500 bytes
Requests per second:  903.26 [#/sec] (mean)
Time per request:     11.071 [ms] (mean)
Time per request:     1.107 [ms] (mean, across all concurrent requests)
Transfer rate:        672.15 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median  max
Connect:      0    3   2.5      2    9
Processing:   1    8   3.2      8   16
Waiting:      1    8   3.2      8   16
Total:        1   11   2.9     11   18

Percentage of the requests served within a certain time (ms)
 50%    11
 66%    12
 75%    13
 80%    13
 90%    14
 95%    16
 98%    18
 99%    18
100%    18 (longest request)
root@Revolte:/#
```

- 2 worker

```
Benchmarking www.granz.channel.e27.com (be patient).....done

Server Software:      nginx/1.14.2
Server Hostname:      www.granz.channel.e27.com
Server Port:          80

Document Path:        /
Document Length:       625 bytes

Concurrency Level:     10
Time taken for tests:   0.119 seconds
Complete requests:      100
Failed requests:         0
Total transferred:      76200 bytes
HTML transferred:       62500 bytes
Requests per second:    840.58 [#/sec] (mean)
Time per request:       11.897 [ms] (mean)
Time per request:       1.190 [ms] (mean, across all concurrent requests)
Transfer rate:          625.51 [Kbytes/sec] received

Connection Times (ms)
      min   mean[+/-sd] median   max
Connect:    0     1   1.1      1     6
Processing:  1    10   4.3     11    26
Waiting:    1    10   4.2     10    26
Total:      1    11   3.6     11    27

Percentage of the requests served within a certain time (ms)
 50%    11
 66%    13
 75%    13
 80%    14
 90%    16
 95%    18
 98%    19
 99%    27
100%    27 (longest request)
root@Revolte:/#
```

- 1 worker

```
Benchmarking www.granz.channel.e27.com (be patient).....done

Server Software:      nginx/1.14.2
Server Hostname:      www.granz.channel.e27.com
Server Port:          80

Document Path:        /
Document Length:      625 bytes

Concurrency Level:    10
Time taken for tests:  0.120 seconds
Complete requests:    100
Failed requests:       0
Total transferred:    76200 bytes
HTML transferred:     62500 bytes
Requests per second:  833.97 [#/sec] (mean)
Time per request:     11.991 [ms] (mean)
Time per request:     1.199 [ms] (mean, across all concurrent requests)
Transfer rate:        620.59 [Kbytes/sec] received

Connection Times (ms)
      min    mean[+/-sd] median    max
Connect:    0      2   2.5      1     12
Processing:  1     10   4.0     10     19
Waiting:    1      9   4.1     10     19
Total:      2     11   3.3     11     19

Percentage of the requests served within a certain time (ms)
 50%    11
 66%    12
 75%    13
 80%    15
 90%    17
 95%    18
 98%    19
 99%    19
100%    19 (longest request)
```

worker

