

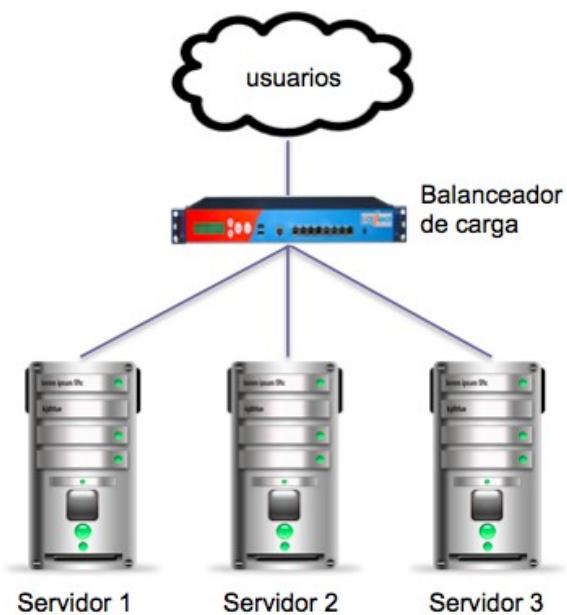
## SERVIDORES WEB DE ALTAS PRESTACIONES

### PRÁCTICA 3: BALANCEO DE CARGA EN UN SITIO WEB



**HAPROXY**

**NGINX**



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## 1. Introducción: Objetivos y cuestiones a resolver

El objetivo principal de la práctica es diseñar una distribución de balanceo de carga para la granja web repartiendo la misma entre varios servidores finales. De esta forma conseguiremos una infraestructura redundante y de alta disponibilidad. Las tareas a realizar son las siguientes:

- Instalar y configurar **nginx** y **HAProxy** como balanceadores de carga con el algoritmo **round-robin** y con **ponderación**.
  - Habilitar el **módulo de estadísticas** de Haproxy
  - Instalar y configurar otros balanceadores de carga como **Gobetween**, **Zevenet**, **Pound**...
  - Someter a la granja web a una alta carga con la herramienta **Apache Benchmark**.
  - Realizar un **análisis comparativo** de los resultados considerando el número de peticiones por unidad de tiempo.

## 2. Instalación y configuración de Nginx

El proceso de instalación en Ubuntu se basa en el uso de **apt-get** para descargarlo de los repositorios oficiales.

```
daarso98@m3-darso98:~$ sudo apt-get update && sudo apt-get dist-upgrade && sudo apt-get autoremove
Hit:1 http://es.archive.ubuntu.com/ubuntu bionic InRelease
Hit:2 http://es.archive.ubuntu.com/ubuntu bionic-updates InRelease
Hit:3 http://es.archive.ubuntu.com/ubuntu bionic-backports InRelease
Hit:4 http://es.archive.ubuntu.com/ubuntu bionic-security InRelease
Reading package lists... Done
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following NEW packages will be installed:
  motd-news-config
The following packages will be upgraded:
  base-files bcache-tools cloud-init cryptsetup cryptsetup-bin dirmngr friendly-recovery gnupg
  gnupg-n11on gnupg-utils gpg gpg-agent gpg-wks-client gpg-wks-server gpgconf gnsm gpgv
```

```
daars098@m3-daars098:~$ sudo apt-get install nginx
```

Lanzamos el servicio y comprobamos el estado con la herramienta `systemctl`

```
daarso98@m3-daarso98:~$ sudo systemctl start nginx
daarso98@m3-daarso98:~$ sudo systemctl status nginx
● nginx.service - A high performance web server and a reverse proxy server
  Loaded: loaded (/lib/systemd/system/nginx.service; enabled; vendor preset: enabled)
  Active: active (running) since Tue 2021-04-06 17:33:04 UTC; 44s ago
    Docs: man:nginx(8)
 Main PID: 16446 (nginx)
    Tasks: 2 (limit: 1107)
   CGroup: /system.slice/nginx.service
           └─16446 nginx: master process /usr/sbin/nginx -g daemon on; master_process on;
               ├─16449 nginx: worker process

Apr 06 17:33:03 m3-daarso98 systemd[1]: Starting A high performance web server and a reve
Apr 06 17:33:04 m3-daarso98 systemd[1]: nginx.service: Failed to parse PID from file /run
Apr 06 17:33:04 m3-daarso98 systemd[1]: Started A high performance web server and a rever
```

Una vez instalado, estamos listos para configurar nginx. En primer lugar, nos dirigimos al archivo **/etc/nginx/nginx.conf** y deshabilitamos el servidor web para que actue como balanceador. Para ello comentamos la siguiente línea: **#include /etc/nginx/sites-enabled/\*.conf**

```
GNU nano 2.9.3                               /etc/nginx/nginx.conf                                Modified

    ssl_protocols TLSv1 TLSv1.1 TLSv1.2; # Dropping SSLv3, ref: POODLE
    ssl_prefer_server_ciphers on;

    ##
    # Logging Settings
    ##

    access_log /var/log/nginx/access.log;
    error_log /var/log/nginx/error.log;

    ##
    # Gzip Settings
    ##

    gzip on;

    # gzip_vary on;
    # gzip_proxied any;
    # gzip_comp_level 6;
    # gzip_buffers 16 8k;
    # gzip_http_version 1.1;
    # gzip_types text/plain text/css application/json application/javascript text/xml applicati

    ##
    # Virtual Host Configs
    ##

    include /etc/nginx/conf.d/*.conf;
    #include /etc/nginx/sites-enabled/*;
```

A continuación, nos dirigimos al archivo **/etc/nginx/conf.d/default.conf** donde se encuentra la configuración básica de nginx. En mi caso, he tenido que crear el fichero ya que este no existía.

```
daarso98@m3-daarso98:/etc/nginx/conf.d$ sudo touch default.conf
[sudo] password for daarso98:
daarso98@m3-daarso98:/etc/nginx/conf.d$ ls -l
total 0
-rw-r--r-- 1 root root 0 Apr  7 13:59 default.conf
```

Primero definimos que máquinas formarán el cluster web y en qué puertos se escucha, en la sección **upstream** de la configuración. Indicaremos las direcciones IP de todos los servidores finales.

Posteriormente, indicamos en la sección **server**: el puerto, el nombre del servidor, donde se encuentran los logs, ... Tambien es importante para que el proxy\_pass funcione correctamente que indiquemos que la conexión entre nginx y los servidores finales se hace con HTTP 1.1.

```
daarso98@m3-daarso98:/$ cat /etc/nginx/conf.d/default.conf
upstream balanceo_daarso98{
    server 192.168.56.104:8080;
    server 192.168.56.105;
}

server{
    listen 80;
    server_name balanceador_daarso98;

    access_log /var/log/nginx/balanceador_daarso98.access.log;
    error_log /var/log/nginx/balanceador_daarso98.error.log;
    root /var/www/;

    location /
    {
        proxy_pass http://balanceo_daarso98;
        proxy_set_header Host $host;
        proxy_set_header X-Real-IP $remote_addr;
        proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
        proxy_http_version 1.1;
        proxy_set_header Connection "";
    }
}
```

En este ejemplo hemos usado balanceo mediante el algoritmo **round-robin** con la misma propiedad para todos los servidores.

Una vez que lo tenemos configurado, lanzamos el servicio.

```
daarso98@m3-daarso98:/$ sudo systemctl start nginx
daarso98@m3-daarso98:/$ sudo service nginx restart
daarso98@m3-daarso98:/$ sudo systemctl status nginx
● nginx.service - A high performance web server and a reverse proxy server
  Loaded: loaded (/lib/systemd/system/nginx.service; enabled; vendor preset: enabled)
  Active: active (running) since Wed 2021-04-07 14:26:17 UTC; 7s ago
    Docs: man:nginx(8)
 Process: 17838 ExecStop=/sbin/start-stop-daemon --quiet --stop --retry QUIT/5 --pidfile /run/ngi
 Process: 17852 ExecStart=/usr/sbin/nginx -g daemon on; master_process on; (code=exited, status=0)
 Process: 17841 ExecStartPre=/usr/sbin/nginx -t -q -g daemon on; master_process on; (code=exited,
Main PID: 17853 (nginx)
   Tasks: 2 (limit: 1107)
  CGroup: /system.slice/nginx.service
          └─17853 nginx: master process /usr/sbin/nginx -g daemon on; master_process on;
              ├─17854 nginx: worker process

Apr 07 14:26:17 m3-daarso98 systemd[1]: Stopped A high performance web server and a reverse proxy.
Apr 07 14:26:17 m3-daarso98 systemd[1]: Starting A high performance web server and a reverse proxy...
Apr 07 14:26:17 m3-daarso98 systemd[1]: nginx.service: Failed to parse PID from file /run/nginx.pi
Apr 07 14:26:17 m3-daarso98 systemd[1]: Started A high performance web server and a reverse proxy.
```

Si no obtenemos ningún mensaje de error, todo esta funcionando correctamente y ya podemos probar la configuración haciendo peticiones a la IP de esta máquina, para ello utilizamos el comando **curl**.

```
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
    body {
        width: 35em;
        margin: 0 auto;
        font-family: Tahoma, Verdana, Arial, sans-serif;
    }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>

<p>For online documentation and support please refer to
<a href="http://nginx.org/">nginx.org</a>.<br/>
Commercial support is available at
<a href="http://nginx.com/">nginx.com</a>.</p>

<p><em>Thank you for using nginx.</em></p>
</body>
</html>
```

Para comprobar el funcionamiento de los balanceadores, el *index.html* de las máquinas finales debe de ser diferente para ver que las respuestas son diferentes. Además tenemos que desabilitar la opción de sincronizar directorios www de la práctica anterior

```
GNU nano 2.9.3                               /tmp/crontab.qu24T0/crontab                         Modified
# Edit this file to introduce tasks to be run by cron.
#
# Each task to run has to be defined through a single line
# indicating with different fields when the task will be run
# and what command to run for the task
#
# To define the time you can provide concrete values for
# minute (m), hour (h), day of month (dom), month (mon),
# and day of week (dow) or use '*' in these fields (for 'any').#
# Notice that tasks will be started based on the cron's system
# daemon's notion of time and timezones.
#
# Output of the crontab jobs (including errors) is sent through
# email to the user the crontab file belongs to (unless redirected).
#
# For example, you can run a backup of all your user accounts
# at 5 a.m every week with:
# 0 5 * * 1 tar -zcf /var/backups/home.tgz /home/
#
# For more information see the manual pages of crontab(5) and cron(8)
#
# m h  dom mon dow   command
#* * * * * rsync -avz -e 'ssh -p 2222 -i ~/.ssh/mykey' 192.168.56.104:/var/www/ /var/www/
```

```
daarso98@m1-daarso98:/var/www/html$ cat index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
  </BODY>
</HTML>
```

```
daarso98@m2-daarso98:/var/www/html$ cat index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 2 DE DAARSO98 192.168.56.105
  </BODY>
</HTML>
```

Una vez hecha esta modificación, la comprobación de curl (con el algoritmo **round-robin**) sería la siguiente:

```
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 2 DE DAARSO98 192.168.56.105
  </BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
  </BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 2 DE DAARSO98 192.168.56.105
  </BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
  </BODY>
</HTML>
```

Por otro lado, si sabemos que alguna de las máquinas finales es más potente, podemos modificar la definición del upstream para pasarle más tráfico que el resto. Para ello tenemos weight, al que le damos un valor numérico que indica la carga que le asignamos.

En nuestro caso, supongamos que la máquina m1 tiene el doble de capacidad que la máquina m2, por tanto el algoritmo con **ponderación** sería el siguiente:

```
GNU nano 2.9.3                               /etc/nginx/conf.d/default.conf

upstream balanceo_daars098{
    server 192.168.56.104:8080 weight=2 ;
    server 192.168.56.105 weight=1;
}

server{
    listen 80;
    server_name balanceador_daars098;

    access_log /var/log/nginx/balanceador_daars098.access.log;
    error_log /var/log/nginx/balanceador_daars098.error.log;
    root /var/www/;

    location /
    {
        proxy_pass http://balanceo_daars098;
        proxy_set_header Host $host;
        proxy_set_header X-Real-IP $remote_addr;
        proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
        proxy_http_version 1.1;
        proxy_set_header Connection "";
    }
}
```

De cada 3 peticiones, 2 son servidas por la máquina m1 y 1 por la máquina m2

```
(base) daars0@daars0-GP62-7RE:~$ curl http://192.168.56.106
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 1 DE DAARS098 192.168.56.104
</BODY>
</HTML>
(base) daars0@daars0-GP62-7RE:~$ curl http://192.168.56.106
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 1 DE DAARS098 192.168.56.104
</BODY>
</HTML>
(base) daars0@daars0-GP62-7RE:~$ curl http://192.168.56.106
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 2 DE DAARS098 192.168.56.105
</BODY>
</HTML>
```

## ■ Opciones Avanzadas Nginx:

Nginx nos ofrece múltiples opciones más avanzadas para gestionar el balanceo de carga en las máquinas servidoras finales. Algunas de ellas son las siguientes:

- **ip\_hash:** se realiza el balanceo por IP. Todas las peticiones que vengan de la misma IP se dirigirán a la misma máquina servidora final.
- **down:** se marca el servidor como offline (se usa junto a ip\_hash)

```
upstream balanceo_daars098{
    ip_hash;
    server 192.168.56.104:8080;
    server 192.168.56.105 down;
}

server{
    listen 80;
    server_name balanceador_daars098;

    access_log /var/log/nginx/balanceador_daars098.access.log;
    error_log /var/log/nginx/balanceador_daars098.error.log;
    root /var/www/;

    location /
    {
        proxy_pass http://balanceo_daars098;
        proxy_set_header Host $host;
        proxy_set_header X-Real-IP $remote_addr;
        proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
        proxy_http_version 1.1;
        proxy_set_header Connection "";
    }
}
```

```
(base) daars0@daars0-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 1 DE DAARS098 192.168.56.104
</BODY>
</HTML>
(base) daars0@daars0-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 1 DE DAARS098 192.168.56.104
</BODY>
</HTML>
(base) daars0@daars0-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 1 DE DAARS098 192.168.56.104
</BODY>
</HTML>
(base) daars0@daars0-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 1 DE DAARS098 192.168.56.104
</BODY>
</HTML>
```

- **max\_fails:** se especifica un número de intentos de comunicación erróneos, llegado el caso se marcará el servidor como no operativo.

- **fail\_timeout:** tiempo en el deben ocurrir ‘max\_fails’ intentos fallidos de conexión.

```

upstream balanceo_daarso98{
    server 192.168.56.104:8080;
    server 192.168.56.105 max_fails=3 fail_timeout=30s;
}

server{
    listen 80;
    server_name balanceador_daarso98;

    access_log /var/log/nginx/balanceador_daarso98.access.log;
    error_log /var/log/nginx/balanceador_daarso98.error.log;
    root /var/www/;

    location /
    {
        proxy_pass http://balanceo_daarso98;
        proxy_set_header Host $host;
        proxy_set_header X-Real-IP $remote_addr;
        proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
        proxy_http_version 1.1;
        proxy_set_header Connection "";
    }
}

```

- **KeepAlive:** se indica un tiempo de mantenimiento de la conexión en segundos

```

upstream balanceo_daarso98{
    server 192.168.56.104:8080;
    server 192.168.56.105;
    keepalive 3;
}

server{
    listen 80;
    server_name balanceador_daarso98;

    access_log /var/log/nginx/balanceador_daarso98.access.log;
    error_log /var/log/nginx/balanceador_daarso98.error.log;
    root /var/www/;

    location /
    {
        proxy_pass http://balanceo_daarso98;
        proxy_set_header Host $host;
        proxy_set_header X-Real-IP $remote_addr;
        proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
        proxy_http_version 1.1;
        proxy_set_header Connection "";
    }
}

```

### 3. Instalación y configuración de HAProxy

**HAProxy** es un balanceador de carga y tambien proxy, de forma que puede balancear cualquier tipo de tráfico. Para instalar HAProxy utilizaremos **apt-get** accediendo a los repositorios oficiales de Ubuntu

```
daarso98@m3-dhaarso98:/$ sudo apt-get install haproxy
```

Lanzamos el servicio y comprobamos el estado con **systemctl**

```
daarso98@m3-dhaarso98:/$ sudo systemctl start haproxy
daarso98@m3-dhaarso98:/$ sudo systemctl status haproxy
● haproxy.service - HAProxy Load Balancer
  Loaded: loaded (/lib/systemd/system/haproxy.service; enabled; vendor preset: enabled)
  Active: active (running) since Wed 2021-04-07 17:10:36 UTC; 1min 8s ago
    Docs: man:haproxy(1)
          file:/usr/share/doc/haproxy/configuration.txt.gz
 Main PID: 18556 (haproxy)
   Tasks: 2 (limit: 1107)
  CGroup: /system.slice/haproxy.service
          └─18556 /usr/sbin/haproxy -Ws -f /etc/haproxy/haproxy.cfg -p /run/haproxy.pid
              ├─18567 /usr/sbin/haproxy -Ws -f /etc/haproxy/haproxy.cfg -p /run/haproxy.pid

Apr 07 17:10:36 m3-dhaarso98 systemd[1]: Starting HAProxy Load Balancer...
Apr 07 17:10:36 m3-dhaarso98 systemd[1]: Started HAProxy Load Balancer.
```

Tanto Nginx como HAProxy están escuchando en el mismo puerto (80), por tanto los dos a la vez no pueden estar funcionando. Se debe parar uno e iniciar el otro:

```
daarso98@m3-dhaarso98:/$ sudo service nginx stop
daarso98@m3-dhaarso98:/$ sudo systemctl status nginx
● nginx.service - A high performance web server and a reverse proxy server
  Loaded: loaded (/lib/systemd/system/nginx.service; enabled; vendor preset: enabled)
  Active: inactive (dead) since Wed 2021-04-07 17:12:40 UTC; 57s ago
    Docs: man:nginx(8)
  Process: 18844 ExecStop=/sbin/start-stop-daemon --quiet --stop --retry QUIT/5 --pid
 Main PID: 18368 (code=exited, status=0/SUCCESS)

Apr 07 17:06:20 m3-dhaarso98 systemd[1]: Stopped A high performance web server and a r
Apr 07 17:06:20 m3-dhaarso98 systemd[1]: Starting A high performance web server and a r
Apr 07 17:06:20 m3-dhaarso98 systemd[1]: nginx.service: Failed to parse PID from file
Apr 07 17:06:20 m3-dhaarso98 systemd[1]: Started A high performance web server and a r
Apr 07 17:12:40 m3-dhaarso98 systemd[1]: Stopping A high performance web server and a r
Apr 07 17:12:40 m3-dhaarso98 systemd[1]: Stopped A high performance web server and a r
```

Una vez instalado, procedemos a modificar el archivo de configuración **/etc/haproxy/haproxy.cfg** para indicar cuales son los servidores y que peticiones balancear.

En el siguiente ejemplo se muestra el algoritmo de **round-robin** y su comprobación con la herramienta **curl**

```
frontend http-in
    bind *:80
    default_backend balanceo_daarso98

backend balanceo_daarso98
    server m1 192.168.56.104:8080 maxconn 32
    server m2 192.168.56.105:80    maxconn 32
```

```
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 2 DE DAARSO98 192.168.56.105
  </BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
  </BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 2 DE DAARSO98 192.168.56.105
  </BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
  </BODY>
</HTML>
```

Ahora probaremos el algoritmo de **ponderación**, redirigiendo el tráfico con el uso de unos determinados pesos.

```
frontend http-in
    bind *:80
    default_backend balanceo_daarso98

backend balanceo_daarso98
    server m1 192.168.56.104:8080 maxconn 32 weight 2
    server m2 192.168.56.105:80    maxconn 32 weight 1 _
```

```
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
  </BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
  </BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 2 DE DAARSO98 192.168.56.105
  </BODY>
</HTML>
```

## ■ Opciones Avanzadas HAProxy:

HAProxy nos ofrece otras opciones de configuración que se muestran a continuación:

- **balance leastconn:** algoritmo de balanceo donde se redirige el tráfico en función del número de conexiones recibidas. Se dirige hacia el servidor con menos conexiones.
- **cookie SERVERUSED insert indirect nocache:** habilita la persistencia basada en cookies. Le dice a HAProxy que envíe una cookie llamada SERVERUSED al cliente y que la asocie con el nombre del servidor que dio la respuesta inicial. Esto hace que el cliente continúe hablando con ese servidor durante la duración de su sesión. En mi caso se insertará el cookie de forma indirecta y sin cacheo.

```
frontend http-in
  bind *:80
  default_backend balanceo_daarso98

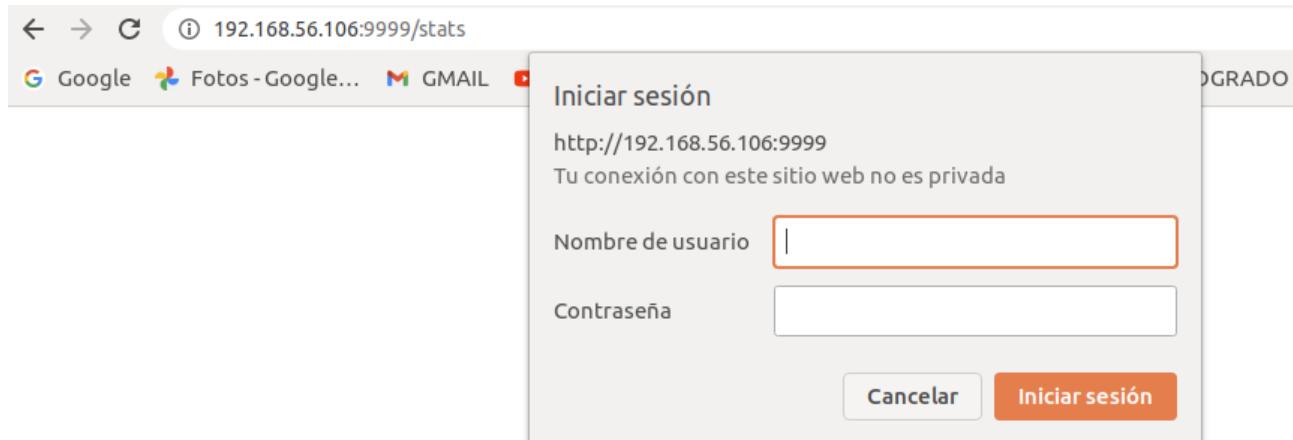
backend balanceo_daarso98
  balance leastconn
  cookie SERVERUSED insert indirect nocache
  server m1 192.168.56.104:8080 maxconn 32 cookie m1
  server m2 192.168.56.105:80   maxconn 32 cookie m2
```

### 3.1 Módulo de estadísticas de HAProxy

Una opción que no puede faltar es habilitar el **módulo de estadísticas** de HAProxy. Se realiza cambiando la configuración en el archivo **/etc/haproxy/haproxy.cfg** incluyendo `stats socket /var/lib/haproxy/stats` en la directiva **global** y añadiendo la siguiente configuración:

```
listen stats
    bind *:9999
    mode http
    stats enable
    stats uri /stats
    stats realm HAProxy\ Statistics
    stats auth daarso98:daarso98
```

Como se puede apreciar en la imagen, la etiqueta **bind** nos indica el puerto en el que escuchan las estadísticas (9999). Para comprobar su funcionamiento simplemente nos dirigimos a la URL de la siguiente imagen, sin olvidarnos de introducir el usuario:daarso98 y contraseña:daarso98



**General process information**

pid = 19970 (process #1, rbrproc = 1, rbrthread = 1)  
upstream = 0d 29m00s  
system = 0d 29m00s  
maxconn = unlimited; ulimit.n = 4042  
maxsock = 4042; maxconn = 2000; maxpipes = 0  
current conn = 16; current pipes = 0; conn rate = 1/sec  
running tasks: 16; idle = 13.94%

**http-in**

Queue			Session rate			Sessions			Bytes			Denied			Errors			Warnings			Server								
Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Req	Resp	Req	Conn	Resp	Retr	Redis	Status	LastChk	Wght	Act	Bck	Chk	Dwn	Downtme	Thrtle
Frontend	0	3 273	-	0	20	2 000	20 009	1 841 096	7 103 111	0	0	0	0	0	0	0	0	0	0	0	OPEN								

**balancer daarso98**

Queue			Session rate			Sessions			Bytes			Denied			Errors			Warnings			Server								
Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Req	Resp	Req	Conn	Resp	Retr	Redis	Status	LastChk	Wght	Act	Bck	Chk	Dwn	Downtme	Thrtle
m1	0	0	-	0	1 639	0	9	32	10 009	10 009	44m55s	921 132	3 543 187	0	0	0	0	0	0	0	no check	1	Y	-					
m2	0	0	-	0	1 635	0	9	32	10 000	10 000	52m30s	919 964	3 559 924	0	0	0	0	0	0	0	no check	1	Y	-					
Backend	0	0	-	0	3 273	0	17	200	20 009	20 009	44m55s	1 841 096	7 103 111	0	0	0	0	0	0	0	2h2m UP	2	2	0			0	0s	

**stats**

Queue			Session rate			Sessions			Bytes			Denied			Errors			Warnings			Server								
Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Req	Resp	Req	Conn	Resp	Retr	Redis	Status	LastChk	Wght	Act	Bck	Chk	Dwn	Downtme	Thrtle
Frontend	0	0	0	1	2	-	1	2	2 000	5	0s	1 844	19 045	0	0	1	2	0	0	0	2h2m UP		0	0	0		0		
Backend	0	0	0	0	1	200	2	0	1 844	19 045	0s	1 844	19 045	0	0	0	2	0	0	0	2h2m UP		0	0	0		0		

## ■ Opciones Avanzadas del módulo de estadísticas de HAProxy:

Algunas de las opciones que nos ofrece este módulo son las siguientes:

- **stats refresh:** refresca las estadística cada cierto instante
- **stats show-legends:** documenta información adicional como : capacidades, modo, id, Ip y cookies
- **stats show-node:** documenta información sobre el host
- **stats hide-version:** activa estadísticas y elimina la versión del HAProxy del informe

```
listen stats
    bind *:9999
    mode http
    stats enable
    stats uri /stats
    stats realm HAProxy\ Statistics
    stats auth daarso98:daarso98
    stats refresh 30s
    stats show-legends
    stats show-node
    stats hide-version
```

## 4. Instalación y configuración de Gobetween

Gobetween es gratuito, de código abierto, moderno y minimalista. Es un equilibrador de carga y proxy inverso para la nueva era de la nube. Para su instalación utilizaremos la herramienta **snapd** que puede ser instalada con apt-get.

```
daarso98@m3-darso98:/$ sudo apt install snapd  
daarso98@m3-darso98:/$ sudo snap install gobetween --edge
```

Lanzamos el servicio y comprobamos el estado del mismo

```
daarso98@m3-darso98:/$ sudo snap start gobetween  
Started.  
daarso98@m3-darso98:/snap/gobetween/57/config$ sudo snap services  
Service           Startup  Current  Notes  
gobetween.gobetween  enabled   active   -
```



Continuando con la misma dinámica que en los balanceadores anteriores, nos dirigimos al archivo de configuración que encontraremos en **/var/snap/gobetween/common/gobetween.toml**

Aplicamos el algoritmo **round-robin** (hemos aplicado el mismo peso a los dos) y comprobamos con la herramienta curl.

```
GNU nano 2.9.3                               gobetween.toml                         Modified

#
#[acme]                                     # (optional)
#challenge = "http"                         # (optional) http | sni | dns
#http_bind = "0.0.0.0:80"                     # (optional) It is possible to bind to other port, but letsencrypt
#cache_dir = "/tmp"                          # (optional) directory to put acme certificates

#
#[servers]                                    [servers.daarso98]
# Servers contains as many [server.<name>] sections as needed.
#[servers]

[servers.daarso98]
protocol = "tcp"
bind = "0.0.0.0:2000"
    [servers.daarso98.discovery]
    kind = "static"
    static_list=[
        "192.168.56.104:8080 weight=1",
        "192.168.56.105:80 weight=1"
    ]
```

Como se observa en la imagen utiliza el puerto 2000 de tcp y eso quedará reflejado en la comprobación

```
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106:2000/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 2 DE DAARSO98 192.168.56.105
  </BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106:2000/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
  </BODY>
</HTML>
```

Aplicamos el algoritmo de **ponderación** y realizamos la comprobación de la misma forma que antes.

```
[servers]

[servers.daarso98]
protocol = "tcp"
bind = "0.0.0.0:2000"
    [servers.daarso98.discovery]
    kind = "static"
    static_list=[
        "iphash",
        "192.168.56.104:8080 weight=2",
        "192.168.56.105:80 weight=1"
    ]
```

```
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106:2000/index.html
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 2 DE DAARS098 192.168.56.105
</BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106:2000/index.html
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 1 DE DAARS098 192.168.56.104
</BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106:2000/index.html
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 1 DE DAARS098 192.168.56.104
</BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106:2000/index.html
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 1 DE DAARS098 192.168.56.104
</BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106:2000/index.html
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 2 DE DAARS098 192.168.56.105
</BODY>
</HTML>
```

## ■ Opciones Avanzadas Gobetween:

Gobetween ofrece más funcionalidades a parte de las ya mencionadas, algunas de ellas son las siguientes:

- **iphash:** El backend de destino se calculará utilizando la función hash del recuento de backends.

```
## [servers]
[servers.daarso98]
protocol = "tcp"
bind = "0.0.0.0:2000"
    [servers.daarso98.discovery]
    kind = "static"
    static_list=[
        "iphash",
        "192.168.56.104:8080 weight=2",
        "192.168.56.105:80 weight=1"
    ]
```

```
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106:2000/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
  </BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106:2000/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
  </BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.106:2000/index.html
<HTML>
  <BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
  </BODY>
</HTML>
```

- **Iphash1:** El backend de destino se calculará utilizando la función hash de la dirección IP del cliente de manera que si algún backend falla, solo los clientes del backend afectado serán enviados a otros backends

```
# [servers]
[servers.daarso98]
protocol = "tcp"
bind = "0.0.0.0:2000"
[servers.daarso98.discovery]
kind = "static"
static_list=[
    "iphash1",
    "192.168.56.104:8080 weight=2",
    "192.168.56.105:80 weight=1"
]
```

- **leastconn:** selecciona el backend con menos conexiones

```
[servers]
[servers.daarso98]
protocol = "tcp"
bind = "0.0.0.0:2000"
[servers.daarso98.discovery]
kind = "static"
static_list=[
    "leastconn",
    "192.168.56.104:8080 weight=2",
    "192.168.56.105:80 weight=1"
]
```

- **leastbandwidth:** Los backends con la suma mínima de tráfico por segundo se seleccionarán para la próxima solicitud

```
# [servers]
[servers.daarso98]
protocol = "tcp"
bind = "0.0.0.0:2000"
[servers.daarso98.discovery]
kind = "static"
static_list=[ "leastbandwidth",
              "192.168.56.104:8080 weight=2",
              "192.168.56.105:80 weight=1"
            ]
```

## 5. Instalación y configuración de Pound

Nos descargamos e instalamos pound del siguiente repositorio con la herramienta **wget**.

```
daarso98@m3-darso98:~$ wget http://kr.archive.ubuntu.com/ubuntu/pool/universe/p/pound/pound_2.6-6.1_amd64.deb
```

```
daarso98@m3-darso98:~$ sudo dpkg -i pound_2.6-6.1_amd64.deb
```

Lanzamos el servicio y comprobamos el estado con **systemctl**

```
daarso98@m3-darso98:~$ pound
starting...
daarso98@m3-darso98:~$ systemctl status pound
● pound.service - LSB: reverse proxy and load balancer
  Loaded: loaded (/etc/init.d/pound; generated)
  Active: active (exited) since Tue 2021-04-13 17:48:05 UTC; 36s ago
    Docs: man:systemd-sysv-generator(8)
   Tasks: 0 (limit: 1107)
  CGroup: /system.slice/pound.service

Apr 13 17:48:04 m3-darso98 systemd[1]: Starting LSB: reverse proxy and load bal
Apr 13 17:48:05 m3-darso98 pound[5542]: * pound will not start unconfigured.
Apr 13 17:48:05 m3-darso98 pound[5542]: * Please configure; afterwards, set st
Apr 13 17:48:05 m3-darso98 systemd[1]: Started LSB: reverse proxy and load bala
```

Si el servicio de Pound escucha en el puerto 80 es necesario parar el servicio de HAProxy de la siguiente forma:

```
daarso98@m3-daarso98:~$ systemctl stop haproxy
==== AUTHENTICATING FOR org.freedesktop.systemd1.manage-units ===
Authentication is required to stop 'haproxy.service'.
Authenticating as: David Armenteros Soto (daarso98)
Password:
==== AUTHENTICATION COMPLETE ===
daarso98@m3-daarso98:~$ systemctl status haproxy
● haproxy.service - HAProxy Load Balancer
  Loaded: loaded (/lib/systemd/system/haproxy.service; enabled; vendor preset: enabled)
  Active: inactive (dead) since Wed 2021-04-14 11:14:28 UTC; 4s ago
    Docs: man:haproxy(1)
          file:/usr/share/doc/haproxy/configuration.txt.gz
   Process: 19969 ExecStart=/usr/sbin/haproxy -Ws -f $CONFIG -p $PIDFILE $EXTRAOPTS (code=exited, st
 Main PID: 19969 (code=exited, status=143)

Apr 08 08:31:05 m3-daarso98 haproxy[19969]: [WARNING] 097/083105 (19969) : config : backend 'balance...
Apr 08 08:31:05 m3-daarso98 haproxy[19969]: [WARNING] 097/083105 (19969) : config : missing timeout
Apr 08 08:31:05 m3-daarso98 haproxy[19969]: | While not properly invalid, you will certainly enc...
Apr 08 08:31:05 m3-daarso98 haproxy[19969]: | with such a configuration. To fix this, please ens...
Apr 08 08:31:05 m3-daarso98 haproxy[19969]: | timeouts are set to a non-zero value: 'client', 'c...
Apr 14 11:14:28 m3-daarso98 systemd[1]: Stopping HAProxy Load Balancer...
Apr 14 11:14:28 m3-daarso98 haproxy[19969]: [WARNING] 097/083105 (19969) : Exiting Master process..
Apr 14 11:14:28 m3-daarso98 haproxy[19969]: [ALERT] 097/083105 (19969) : Current worker 19970 exite...
Apr 14 11:14:28 m3-daarso98 haproxy[19969]: [WARNING] 097/083105 (19969) : All workers exited. Exit...
Apr 14 11:14:28 m3-daarso98 systemd[1]: Stopped HAProxy Load Balancer.
```

En mi caso, he optado por cambiar el puerto al **8081** y así no tener que parar el servicio.

Una vez instalado el servicio de pound, procedemos a su configuración. Para ellos nos dirigimos al archivo **/etc/pound/pound.cfg**. A continuación se muestran dos formas de configuración; una sin prioridad y otra con prioridad

```
## redirect all requests on port 8080 ("ListenHTTP") to the local webserver (see "Service" below):
ListenHTTP
  Address 192.168.56.106
  Port    8081
  ## allow PUT and DELETE also (by default only GET, POST and HEAD)?:
  xHTTP      0

  Service
    BackEnd
      Address 192.168.56.104
      Port    8080
    End

    BackEnd
      Address 192.168.56.105
      Port    80
    End

  End
End
```

```

GNU nano 2.9.3                               /etc/pound/pound.cfg                         Modified
## redirect all requests on port 8080 ("ListenHTTP") to the local webserver (see "Service" below):
ListenHTTP
    Address 192.168.56.106
    Port     8081

    ## allow PUT and DELETE also (by default only GET, POST and HEAD)?:
    xHTTP          0

    Service
        BackEnd
            Address 192.168.56.104
            Port     8080
            Priority 2
        End

        BackEnd
            Address 192.168.56.105
            Port     80
            Priority 1
        End

    End
End

```

En la imagen de arriba se observa como hemos utilizado la opción **Priority**

## ■ Opciones Avanzadas Pound:

- **Client:** indica peticiones por parte del cliente

```

GNU nano 2.9.3                               /etc/pound/pound.cfg                         Modified
## redirect all requests on port 8080 ("ListenHTTP") to the local webserver (see "Service" below):
ListenHTTP
    Address 192.168.56.106
    Port     8081
    Client   2

    ## allow PUT and DELETE also (by default only GET, POST and HEAD)?:
    xHTTP          0

    Service
        BackEnd
            Address 192.168.56.104
            Port     8080
        End

        BackEnd
            Address 192.168.56.105
            Port     80
        End

    End
End

```

- **HTTPS:** se puede configurar pound para su uso de forma segura incluyendo el certificado **/etc/pki/tls/certs/pound.mem** en el puerto **443** con **TLS**

```
## redirect all requests on port 8080 ("ListenHTTP") to the local webserver (see "Service" below):
ListenHTTP
    Address 192.168.56.106
    Port     8081
    ## allow PUT and DELETE also (by default only GET, POST and HEAD)?:
    xHTTP      0

    Service
        BackEnd
            Address 192.168.56.104
            Port     8080
        End

        BackEnd
            Address 192.168.56.105
            Port     80
        End

    End
End

ListenHTTPS
    Address 192.168.56.106
    Port     443
    Cert     "/etc/pki/tls/certs/pound.pem"
```

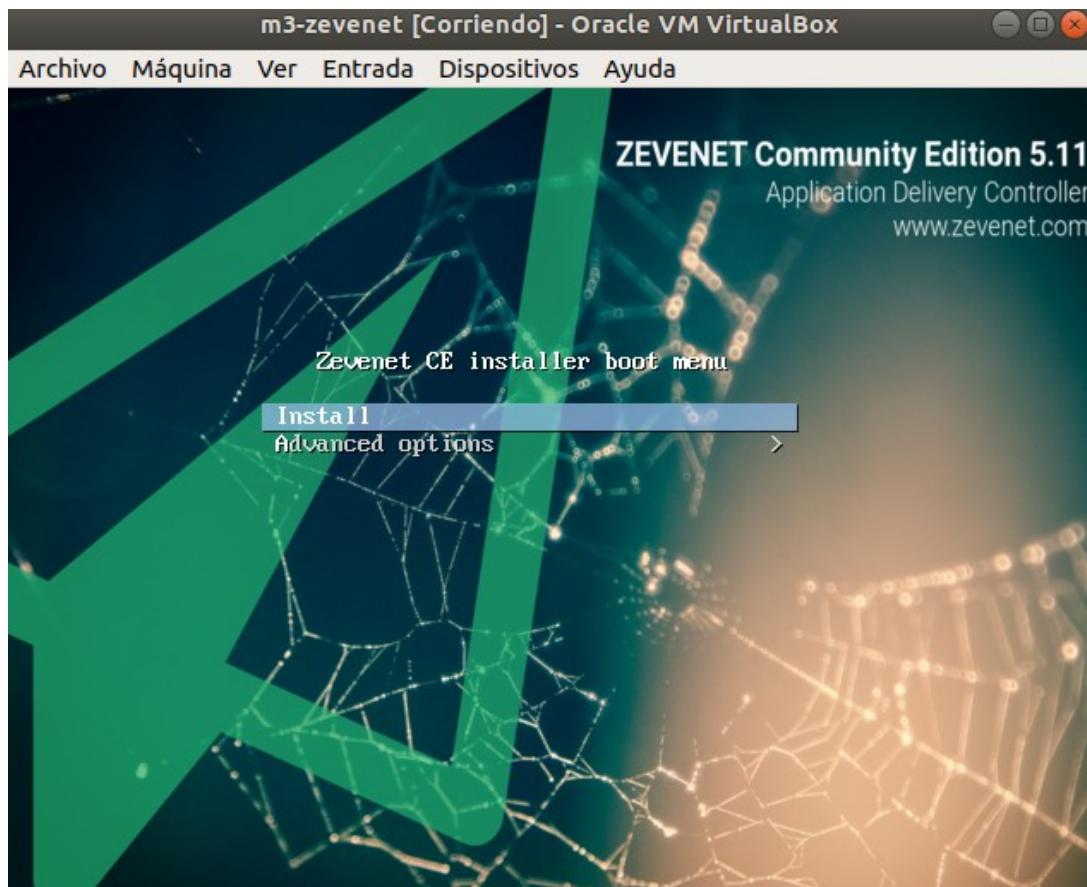
## 6. Instalación y configuración de Zevenet

**Zen Load Balancer** es una solución completa para el equilibrio de carga para proporcionar una alta disponibilidad para TCP, UDP, servicios avanzados de HTTP y HTTPS, etc. Zen LB proporciona una avanzada administración de interfaces y rutas de red, configuración ilimitada de granjas, etc.

Para instalar Zen LB nos dirigimos a su página web oficial:

<https://www.zevenet.com/knowledge-base/community-edition/community-edition-v5-0-administration-guide/ce-v5-0-installation-guide/>

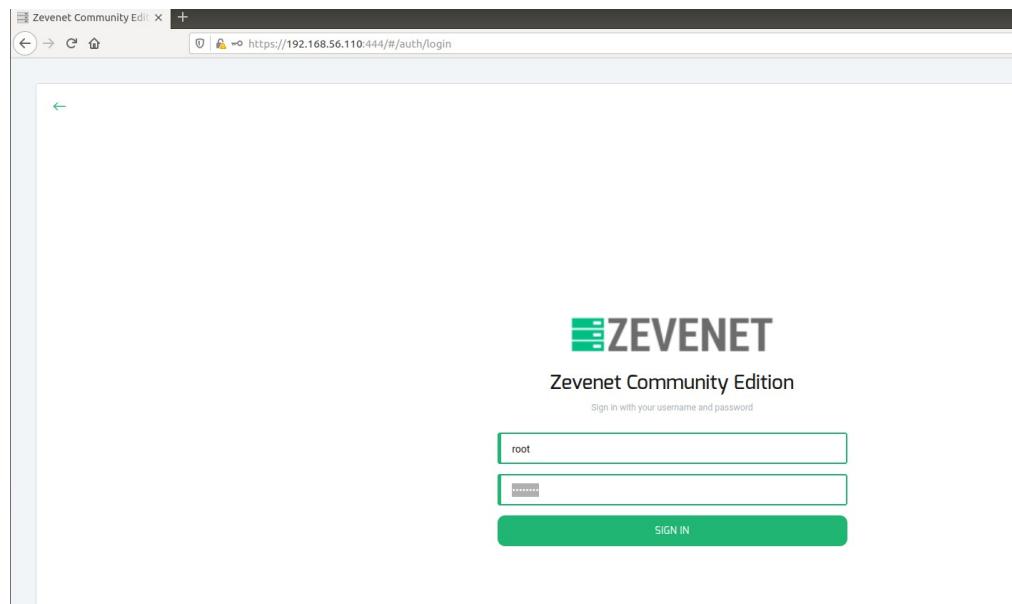
A continuación, nos descargaremos la imagen ISO y comenzaremos la instalación de la máquina virtual de zevenet siguiendo todos los pasos que se indican. La máquina virtual lanzará la siguiente interfaz:



Una vez instalado, procedemos a configurar la red nat y solo-anfitrón con netplan de la siguiente manera:

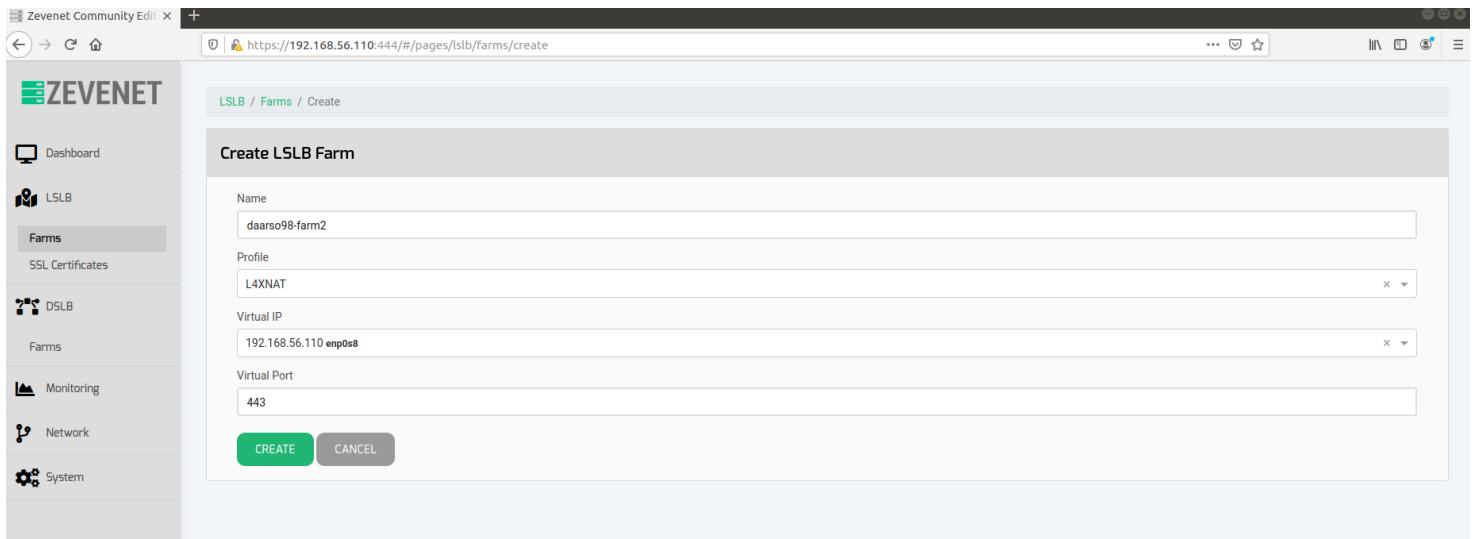
```
root@m3-zevenet:/etc# cd ..
root@m3-zevenet:/# cat /etc/netplan/00-installer-config.yaml
network:
  ethernets:
    enp0s3:
      dhcp4: true
    enp0s8:
      dhcp4: no
      dhcp6: no
      addresses: [192.168.56.110/24, ]
      gateway4: 192.168.56.1
      nameservers:
        addresses: [8.8.8.8, 8.8.4.4]
  version: 2
```

Accedemos a Zeb LB usando la IP **192.168.56.110** configurada anteriormente y el puerto **444**. Introducimos el usuario **root** y la contraseña **Swap1234**



Para configurar nuestra granja web nos dirigimos a LSLB > Farms y la creamos con los siguientes parámetros:

- **profile:** L4XNAT
- **VirtualIP:** 192.168.56.110
- **Puerto:** 443



The screenshot shows the Zevenet Community Edition interface. On the left, there's a sidebar with icons for Dashboard, LSLB, Farms (which is selected), SSL Certificates, DSLB, Farms, Monitoring, Network, and System. The main area has a header 'LSLB / Farms / Create'. Below it, a 'Create LSLB Farm' form is displayed with the following fields:

- Name: daarso98-farm2
- Profile: L4XNAT
- Virtual IP: 192.168.56.110 enp0s8
- Virtual Port: 443

At the bottom of the form are 'CREATE' and 'CANCEL' buttons.

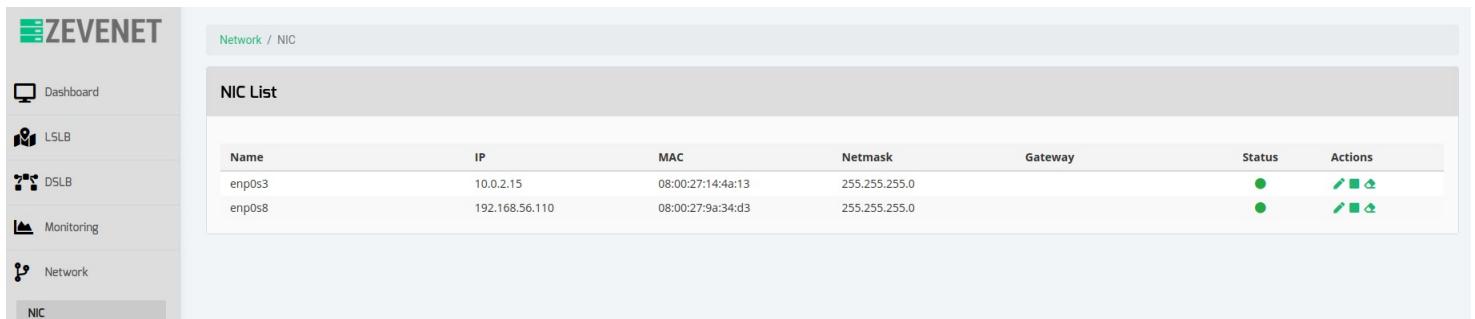
Comprobamos el estado de la granja web y vemos si está corriendo



The screenshot shows the 'LSLB Farm List' page. The sidebar on the left is identical to the previous one. The main area has a header 'LSLB / Farms'. Below it, a table titled 'LSLB Farm List' shows the following data:

LSLB Farm List						
<a href="#">CREATE FARM</a>						
Name	Profile	Virtual IP	Virtual Port	Status	Actions	
daarso98-farm2	l4xnat	192.168.56.110	443	<span style="color: green;">●</span>	<a href="#"><span style="color: green;">edit</span></a>	<a href="#"><span style="color: green;">remove</span></a>

En caso de que no funcionará, se tiene que comprobar que las direcciones IP de la **NIC list** están correctamente añadidas:



The screenshot shows the 'NIC List' page. The sidebar on the left is identical to the previous ones. The main area has a header 'Network / NIC'. Below it, a table titled 'NIC List' shows the following data:

NIC List						
Name	IP	MAC	Netmask	Gateway	Status	Actions
enp0s3	10.0.2.15	08:00:27:14:4a:13	255.255.255.0		<span style="color: green;">●</span>	<a href="#"><span style="color: green;">edit</span></a>
enp0s8	192.168.56.110	08:00:27:9a:34:d3	255.255.255.0		<span style="color: green;">●</span>	<a href="#"><span style="color: green;">edit</span></a>

Llegado este punto, estamos listos para editar la granja web en función del algoritmo que queramos utilizar. Para ello nos dirigimos a LSLB > Farms > edit

Global Settings

Name: daars98-farm2  
Virtual IP and Port: 192.168.56.110:443  
Protocol type: TCP  
Nat type: NAT

SUBMIT

Añadimos las máquinas backend que queremos balancear:

Backend

ID	IP	Port	Priority	Weight	Actions
0	192.168.56.104	8080	1	1	
1	192.168.56.105	80	1	1	

SUBMIT

Finalmente indicamos el algoritmo de balanceo que queramos utilizar. A continuación se mostrarán los algoritmo de **Round-Robin** y **Ponderación** y su correspondiente comprobación con la herramienta **curl**.

## Algoritmo Round-Robin:

Services Settings

Load balancer Algorithm: Round Robin: Sequential backend selection

Persistence: No persistence

Farmguardian

Health Checks for backend: Disabled

Backend

ID	IP	Port	Priority	Weight	Actions
0	192.168.56.104	8080	1	1	
1	192.168.56.105	80	1	1	

SUBMIT

```
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.110:443
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
</BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.110:443
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 2 DE DAARSO98 192.168.56.105
</BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.110:443
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
</BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.110:443
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 2 DE DAARSO98 192.168.56.105
</BODY>
</HTML>
(base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.110:443
<HTML>
<BODY>
    ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
</BODY>
</HTML>
```

## Algoritmo Ponderación:

**Services Settings**

Load balancer Algorithm: Weight: connection linear dispatching by weight

**Persistence**

Persistence: No persistence

**Farmguardian**

Health Checks for backend: Disabled

**Backend**

ID	IP	Port	Priority	Weight	Actions
0	192.168.56.104	8080	1	2	
1	192.168.56.105	80	1	1	

**ADD BACKEND**

**SUBMIT**

```
[base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.110:443/index.html
<HTML>
<BODY>
ESTA ES LA MÁQUINA 2 DE DAARSO98 192.168.56.105
</BODY>
</HTML>
[base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.110:443/index.html
<HTML>
<BODY>
ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
</BODY>
</HTML>
[base) daarso@daarso-GP62-7RE:~$ curl http://192.168.56.110:443/index.html
<HTML>
<BODY>
ESTA ES LA MÁQUINA 1 DE DAARSO98 192.168.56.104
</BODY>
</HTML>
```

## ■ Opciones Avanzadas Zevenet:

- Zeb LB presenta distintos **algoritmos** para el balanceo de carga, simplemente editando la configuración de la granja web. Algunos de ellos son los siguientes:

### Algoritmo Symmetric Hash:

The screenshot shows the 'Services Settings' page of the Zevenet software. It includes sections for Load balancer Algorithm (set to Symmetric Hash), Persistence (set to No persistence), Farmguardian (Health Checks for backend set to Disabled), and Backend (listing two servers: 192.168.56.104 and 192.168.56.105). A green 'ADD BACKEND' button is visible, and a 'SUBMIT' button is at the bottom.

ID	IP	Port	Priority	Weight	Actions
0	192.168.56.104	8080	1	1	
1	192.168.56.105	80	1	1	

## Algoritmo Simple Source:

**Services Settings**

Load balancer Algorithm  
Simple Source Hash: Hash per Source IP only

Persistence

Persistence  
No persistence

Farmguardian

Health Checks for backend  
Disabled

Backend

**ADD BACKEND**

ID	IP	Port	Priority	Weight	Actions
0	192.168.56.104	8080	1	1	
1	192.168.56.105	80	1	1	

**SUBMIT**

## Algoritmo Source Hash:

**Services Settings**

Load balancer Algorithm  
Source Hash: Hash per Source IP and Source Port

Persistence

Persistence  
No persistence

Farmguardian

Health Checks for backend  
Disabled

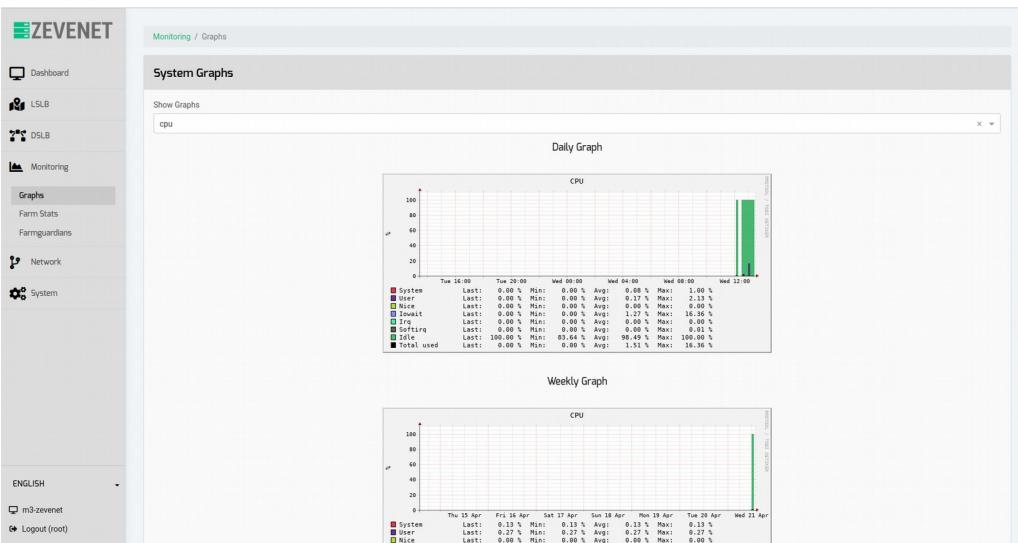
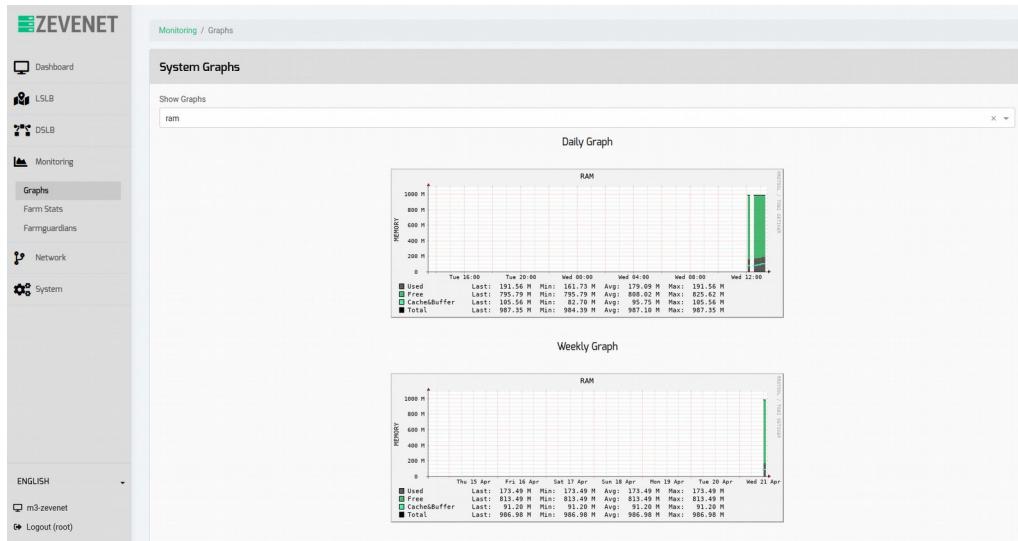
Backend

**ADD BACKEND**

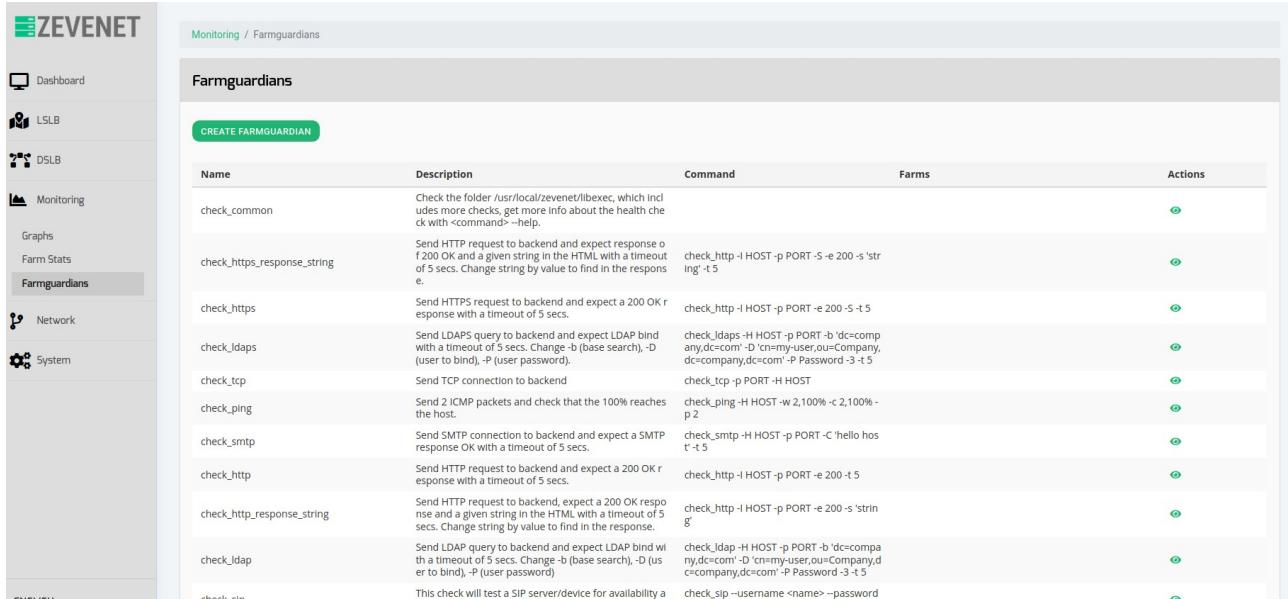
ID	IP	Port	Priority	Weight	Actions
0	192.168.56.104	8080	1	1	
1	192.168.56.105	80	1	1	

**SUBMIT**

- Zeb LB presenta opciones para observar el **rendimiento** de nuestro balanceador mediante la utilización de gráficos que miden el uso de la CPU, RAM,...



- Zeb LB presenta una sección de **Farmguardians** donde se enumeran todos los controles de estado disponibles en el balanceador de carga, describiendo cada uno de ellos. Se utilizan para la supervisión avanzada del estado de los backends. Cuando detecta un problema, automáticamente se desactiva el servidor real y se marca como en la lista negra.



The screenshot shows the ZEBENET monitoring interface. On the left, there's a sidebar with various monitoring and system management links. The main area is titled "Farmguardians" and contains a table of checks. The table has columns for Name, Description, Command, Farms, and Actions. Each row represents a different check type, such as check\_common, check\_https\_response\_string, and check\_http.

Name	Description	Command	Farms	Actions
check_common	Check the folder /usr/local/zevenet/libexec, which includes more checks, get more info about the health check with <commands>-help.			<a href="#">Edit</a>
check_https_response_string	Send HTTP request to backend and expect response of 200 OK and a given string in the HTML with a timeout of 5 secs. Change string by value to find in the response.	check_http -i HOST -p PORT -s 200 -s 'string' -t 5		<a href="#">Edit</a>
check_https	Send HTTPS request to backend and expect a 200 OK response with a timeout of 5 secs.	check_http -i HOST -p PORT -e 200 -s -t 5		<a href="#">Edit</a>
check_ldaps	Send LDAPS query to backend and expect LDAP bind with a timeout of 5 secs. Change -b (base search), -D (user to bind), -P (user password).	check_ldaps -H HOST -p PORT -b 'dc=company,dc=com' -D 'cn=my-user,ou=Company,dc=company,dc=com' -P Password -3 -t 5		<a href="#">Edit</a>
check_tcp	Send TCP connection to backend	check_tcp -p PORT -H HOST		<a href="#">Edit</a>
check_ping	Send 2 ICMP packets and check that the 100% reaches the host	check_ping -H HOST -w 2,100% -c 2,100% -p 2		<a href="#">Edit</a>
check_smtp	Send SMTP connection to backend and expect a SMTP response OK with a timeout of 5 secs.	check_smtp -H HOST -p PORT -C 'hello host' -t 5		<a href="#">Edit</a>
check_http	Send HTTP request to backend and expect a 200 OK response with a timeout of 5 secs.	check_http -i HOST -p PORT -e 200 -t 5		<a href="#">Edit</a>
check_http_response_string	Send HTTP request to backend, expect a 200 OK response and a given string in the HTML with a timeout of 5 secs. Change string by value to find in the response.	check_http -i HOST -p PORT -e 200 -s 'string'		<a href="#">Edit</a>
check_ldap	Send LDAP query to backend and expect LDAP bind with a timeout of 5 secs. Change -b (base search), -D (user to bind), -P (user password)	check_ldap -H HOST -p PORT -b 'dc=company,dc=com' -D 'cn=my-user,ou=Company,dc=company,dc=com' -P Password -3 -t 5		<a href="#">Edit</a>
check_sip	This check will test a SIP server/device for availability	check_sip --username <name> --password		<a href="#">Edit</a>

## 7. Apache Benchmark:carga en la granja web

Para medir el rendimiento de nuestra granja web vamos a utilizar la herramienta **apache benchmark** que se encarga de lanzar peticiones HTTP a nuestra máquina final. De esta forma, vamos a simular el comportamiento real de millones de usuarios que acceden al servidor reclamando servicios. Esta herramienta se instala junto con el servidor de Apache.

A continuación voy a lanzar peticiones a los distintos balanceadores. Para ello ejecutaré el comando **ab** con las siguientes opciones:

- **'-n'**: indica el número de peticiones.
- **'-c'**: indica la concurrencia de esas peticiones.
- **'-l'**: indica que la longitud de los ficheros es variable, si no obtendremos un número de failed request distinto de cero. Ocurre debido a las distintas longitudes de los ficheros hmtl.

Para posteriormente poder realizar un estudio he lanzamos 10000, 150000 , 20000 y 25000 peticiones con una concurrencia de 10 a los distintos balanceadores, tanto con el algoritmo Round-Robin como ponderación.

### ◆ NGINX:

#### Algoritmo Round-Robin:

```
(base) daarsso@daarsso-GP62-7RE:~$ ab -n 10000 -c 10 -l http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/
Benchmarking 192.168.56.106 (be patient)
Completed 1000 requests
Completed 2000 requests
Completed 3000 requests
Completed 4000 requests
Completed 5000 requests
Completed 6000 requests
Completed 7000 requests
Completed 8000 requests
Completed 9000 requests
Completed 10000 requests
Finished 10000 requests

Server Software:      nginx/1.14.0
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 4.677 seconds
Complete requests:  10000
Failed requests:    0
Total transferred:  3540000 bytes
HTML transferred:   860000 bytes
Requests per second: 2138.01 [#/sec] (mean)
Time per request:   0.468 [ms] (mean, across all concurrent requests)
Transfer rate:       739.12 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0.1    0     3
Processing:     1   1.4    4    16
Waiting:       1   1.4    4    16
Total:         1   1.4    4    16

Percentage of the requests served within a certain time (ms)
  50%   4
  66%   5
  75%   5
  80%   5
  90%   7
  95%   8
  98%   9
  99%  10
100%  16 (longest request)

(base) daarsso@daarsso-GP62-7RE:~$ ab -n 15000 -c 10 -l http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/
Benchmarking 192.168.56.106 (be patient)
Completed 1500 requests
Completed 3000 requests
Completed 4500 requests
Completed 6000 requests
Completed 7500 requests
Completed 9000 requests
Completed 10500 requests
Completed 12000 requests
Completed 13500 requests
Completed 15000 requests
Finished 15000 requests

Server Software:      nginx/1.14.0
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 6.636 seconds
Complete requests:  15000
Failed requests:    0
Total transferred:  5310000 bytes
HTML transferred:   1290000 bytes
Requests per second: 2260.40 [#/sec] (mean)
Time per request:   0.442 [ms] (mean)
Time per request:   0.442 [ms] (mean, across all concurrent requests)
Transfer rate:       781.43 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0.2    0     10
Processing:     1   1.7    4     26
Waiting:       1   1.7    4     26
Total:         1   1.7    4     26

Percentage of the requests served within a certain time (ms)
  50%   4
  66%   4
  75%   5
  80%   5
  90%   5
  95%   6
  98%   8
  99%  11
100%  26 (longest request)
```

```
[base] daarso@daarso-GP62-7RE:~$ ab -n 20000 -c 10 -l http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/
Benchmarking 192.168.56.106 (be patient)
Completed 2000 requests
Completed 4000 requests
Completed 6000 requests
Completed 8000 requests
Completed 10000 requests
Completed 12000 requests
Completed 14000 requests
Completed 16000 requests
Completed 18000 requests
Completed 20000 requests
Finished 20000 requests

Server Software:      nginx/1.14.0
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 8.561 seconds
Complete requests: 20000
Failed requests: 0
Total transferred: 7080000 bytes
HTML transferred: 1720000 bytes
Requests per second: 2336.19 [/sec] (mean)
Time per request: 0.428 [ms] (mean, across all concurrent requests)
Transfer rate: 807.63 [kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:       0    0  0.1    0    6
Processing:    1    4  2.5    4   108
Waiting:      0    4  2.5    4   108
Total:        1    4  2.5    4   108

Percentage of the requests served within a certain time (ms)
  50%    4
  66%    4
  75%    4
  80%    5
  90%    5
  95%    6
  98%    7
  99%    8
100%  108 (longest request)

[base] daarso@daarso-GP62-7RE:~$ ab -n 25000 -c 10 -l http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/
Benchmarking 192.168.56.106 (be patient)
Completed 2500 requests
Completed 5000 requests
Completed 7500 requests
Completed 10000 requests
Completed 12500 requests
Completed 15000 requests
Completed 17500 requests
Completed 20000 requests
Completed 22500 requests
Completed 25000 requests
Finished 25000 requests

Server Software:      nginx/1.14.0
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 10.808 seconds
Complete requests: 25000
Failed requests: 0
Total transferred: 8850000 bytes
HTML transferred: 2150000 bytes
Requests per second: 2313.00 [/sec] (mean)
Time per request: 0.432 [ms] (mean)
Time per request: 0.432 [ms] (mean, across all concurrent requests)
Transfer rate: 799.61 [kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:       0    0  0.1    0    4
Processing:    1    4  0.9    4   17
Waiting:      0    4  0.9    4   17
Total:        1    4  1.0    4   17

Percentage of the requests served within a certain time (ms)
  50%    4
  66%    4
  75%    5
  80%    5
  90%    5
  95%    6
  98%    7
  99%    8
100%  17 (longest request)
```

## Algoritmo Ponderación:

```
[base] daarso@daarso-GP62-7RE:~$ ab -n 10000 -c 10 -l http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/
Benchmarking 192.168.56.106 (be patient)
Completed 1000 requests
Completed 2000 requests
Completed 3000 requests
Completed 4000 requests
Completed 5000 requests
Completed 6000 requests
Completed 7000 requests
Completed 8000 requests
Completed 9000 requests
Completed 10000 requests
Finished 10000 requests

Server Software:      nginx/1.14.0
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 4.250 seconds
Complete requests: 10000
Failed requests: 0
Total transferred: 3536666 bytes
HTML transferred: 856666 bytes
Requests per second: 2352.98 [/sec] (mean)
Time per request: 0.425 [ms] (mean)
Time per request: 0.425 [ms] (mean, across all concurrent requests)
Transfer rate: 812.67 [kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:       0    0  0.1    0    2
Processing:    1    4  1.0    4   19
Waiting:      1    4  1.0    4   19
Total:        1    4  1.0    4   19

Percentage of the requests served within a certain time (ms)
  50%    4
  66%    4
  75%    5
  80%    5
  90%    5
  95%    6
  98%    7
  99%    7
100%  19 (longest request)

[base] daarso@daarso-GP62-7RE:~$ ab -n 15000 -c 10 -l http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/
Benchmarking 192.168.56.106 (be patient)
Completed 1500 requests
Completed 3000 requests
Completed 4500 requests
Completed 6000 requests
Completed 7500 requests
Completed 9000 requests
Completed 10500 requests
Completed 12000 requests
Completed 13500 requests
Completed 15000 requests
Finished 15000 requests

Server Software:      nginx/1.14.0
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 6.260 seconds
Complete requests: 15000
Failed requests: 0
Total transferred: 5305000 bytes
HTML transferred: 1285000 bytes
Requests per second: 2396.28 [/sec] (mean)
Time per request: 0.417 [ms] (mean)
Time per request: 0.417 [ms] (mean, across all concurrent requests)
Transfer rate: 827.62 [kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:       0    0  0.1    0    2
Processing:    1    4  1.4    4   50
Waiting:      1    4  1.4    4   50
Total:        1    4  1.4    4   50

Percentage of the requests served within a certain time (ms)
  50%    4
  66%    4
  75%    4
  80%    5
  90%    5
  95%    5
  98%    6
  99%    8
100%  50 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 20000 -c 10 -l http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 2000 requests
Completed 4000 requests
Completed 6000 requests
Completed 8000 requests
Completed 10000 requests
Completed 12000 requests
Completed 14000 requests
Completed 16000 requests
Completed 18000 requests
Completed 20000 requests
Finished 20000 requests

Server Software:      nginx/1.14.0
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 8.707 seconds
Complete requests:   20000
Failed requests:    0
Total transferred:  7073334 bytes
HTML transferred:  1713334 bytes
Requests per second: 2297.01 [#/sec] (mean)
Time per request:   4.353 [ms] (mean)
Time per request:   0.435 [ms] (mean, across all concurrent requests)
Transfer rate:       793.34 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.1    0    2
Processing:     1    4  1.6    4   43
Waiting:        0    4  1.6    4   43
Total:         1    4  1.6    4   43

Percentage of the requests served within a certain time (ms)
  50%    4
  66%    4
  75%    5
  80%    5
  90%    5
  95%    7
  98%    9
  99%   11
100%   43 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 25000 -c 10 -l http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 2500 requests
Completed 5000 requests
Completed 7500 requests
Completed 10000 requests
Completed 12500 requests
Completed 15000 requests
Completed 17500 requests
Completed 20000 requests
Completed 22500 requests
Completed 25000 requests
Finished 25000 requests

Server Software:      nginx/1.14.0
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 10.898 seconds
Complete requests:   25000
Failed requests:    0
Total transferred:  8841666 bytes
HTML transferred:  2141666 bytes
Requests per second: 2293.96 [#/sec] (mean)
Time per request:   4.359 [ms] (mean)
Time per request:   0.436 [ms] (mean, across all concurrent requests)
Transfer rate:       792.28 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.1    0    9
Processing:     1    4  1.6    4   17
Waiting:        0    4  1.6    4   17
Total:         1    4  1.6    4   17

Percentage of the requests served within a certain time (ms)
  50%    4
  66%    4
  75%    5
  80%    5
  90%    7
  95%    7
  98%    9
  99%   10
100%   17 (longest request)
```

## ◆ HAProxy:

### Algoritmo Round-Robin:

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 10000 -c 10 -l http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 1000 requests
Completed 2000 requests
Completed 3000 requests
Completed 4000 requests
Completed 5000 requests
Completed 6000 requests
Completed 7000 requests
Completed 8000 requests
Completed 9000 requests
Completed 10000 requests
Finished 10000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 3.212 seconds
Complete requests:   10000
Failed requests:    0
Total transferred:  3550056 bytes
HTML transferred:   860056 bytes
Requests per second: 3113.13 #[#/sec] (mean)
Time per request:   3.212 [ms] (mean)
Time per request:   0.321 [ms] (mean, across all concurrent requests)
Transfer rate:       1079.28 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.1    0    2
Processing:     1    3  1.1    3   16
Waiting:        1    3  1.1    3   16
Total:         1    3  1.1    3   17

Percentage of the requests served within a certain time (ms)
  50%    3
  66%    3
  75%    4
  80%    4
  90%    4
  95%    5
  98%    6
  99%    7
100%   17 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 15000 -c 10 -l http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 1500 requests
Completed 3000 requests
Completed 4500 requests
Completed 6000 requests
Completed 7500 requests
Completed 9000 requests
Completed 10500 requests
Completed 12000 requests
Completed 13500 requests
Completed 15000 requests
Finished 15000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 4.683 seconds
Complete requests:   15000
Failed requests:    0
Total transferred:  5325000 bytes
HTML transferred:   1290000 bytes
Requests per second: 3202.95 #[#/sec] (mean)
Time per request:   3.122 [ms] (mean)
Time per request:   0.312 [ms] (mean, across all concurrent requests)
Transfer rate:       1110.40 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.1    0    3
Processing:     1    3  0.9    3   18
Waiting:        1    3  0.9    3   18
Total:         1    3  1.0    3   18

Percentage of the requests served within a certain time (ms)
  50%    3
  66%    3
  75%    4
  80%    4
  90%    4
  95%    5
  98%    6
  99%    6
100%   18 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 20000 -c 10 -l http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 2000 requests
Completed 4000 requests
Completed 6000 requests
Completed 8000 requests
Completed 10000 requests
Completed 12000 requests
Completed 14000 requests
Completed 16000 requests
Completed 18000 requests
Completed 20000 requests
Finished 20000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 6.587 seconds
Complete requests:   20000
Failed requests:    0
Total transferred:  7100062 bytes
HTML transferred:   1720062 bytes
Requests per second: 3036.41 #[#/sec] (mean)
Time per request:   3.293 [ms] (mean)
Time per request:   0.329 [ms] (mean, across all concurrent requests)
Transfer rate:       1052.67 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.1    0    4
Processing:     1    3  1.1    3   16
Waiting:        1    3  1.1    3   16
Total:         1    3  1.1    3   16

Percentage of the requests served within a certain time (ms)
  50%    3
  66%    3
  75%    4
  80%    4
  90%    5
  95%    5
  98%    6
  99%    7
100%   16 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 25000 -c 10 -l http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
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Benchmarking 192.168.56.106 (be patient)
Completed 2500 requests
Completed 5000 requests
Completed 7500 requests
Completed 10000 requests
Completed 12500 requests
Completed 15000 requests
Completed 17500 requests
Completed 20000 requests
Completed 22500 requests
Completed 25000 requests
Finished 25000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 7.794 seconds
Complete requests:   25000
Failed requests:    0
Total transferred:  8875044 bytes
HTML transferred:   2150044 bytes
Requests per second: 3207.50 #[#/sec] (mean)
Time per request:   3.118 [ms] (mean)
Time per request:   0.312 [ms] (mean, across all concurrent requests)
Transfer rate:       1111.98 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.1    0    2
Processing:     1    3  0.9    3   21
Waiting:        1    3  0.9    3   18
Total:         1    3  0.9    3   21

Percentage of the requests served within a certain time (ms)
  50%    3
  66%    3
  75%    4
  80%    4
  90%    4
  95%    5
  98%    6
  99%    6
100%   21 (longest request)
```

## Algoritmo Ponderación:

```
[base] daarso@daarso-GP62-7RE:~$ ab -n 10000 -c 10 -l http://192.168.56.106/index.html
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Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 1000 requests
Completed 2000 requests
Completed 3000 requests
Completed 4000 requests
Completed 5000 requests
Completed 6000 requests
Completed 7000 requests
Completed 8000 requests
Completed 9000 requests
Completed 10000 requests
Finished 10000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 3.495 seconds
Complete requests:   10000
Failed requests:    0
Total transferred:  3546666 bytes
HTML transferred:  856666 bytes
Requests per second: 2861.31 [#/sec] (mean)
Time per request:   0.349 [ms] (mean)
Time per request:   0.349 [ms] (mean, across all concurrent requests)
Transfer rate:       991.02 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.2      0    5
Processing:    1    3  1.4      3   19
Waiting:       1    3  1.3      3   19
Total:         1    3  1.4      3   19

Percentage of the requests served within a certain time (ms)
  50%   3
  66%   4
  75%   4
  80%   4
  90%   5
  95%   6
  98%   8
  99%   9
 100%  19 (longest request)
```

```
[base] daarso@daarso-GP62-7RE:~$ ab -n 15000 -c 10 -l http://192.168.56.106/index.html
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Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 1500 requests
Completed 3000 requests
Completed 4500 requests
Completed 6000 requests
Completed 7500 requests
Completed 9000 requests
Completed 10500 requests
Completed 12000 requests
Completed 13500 requests
Completed 15000 requests
Finished 15000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 4.732 seconds
Complete requests:   15000
Failed requests:    0
Total transferred:  5320000 bytes
HTML transferred:  1285000 bytes
Requests per second: 3170.14 [#/sec] (mean)
Time per request:   0.314 [ms] (mean)
Time per request:   0.315 [ms] (mean, across all concurrent requests)
Transfer rate:       1097.99 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.1      0    3
Processing:    1    3  1.0      3   21
Waiting:       1    3  1.0      3   21
Total:         1    3  1.0      3   22

Percentage of the requests served within a certain time (ms)
  50%   3
  66%   3
  75%   4
  80%   4
  90%   4
  95%   5
  98%   6
  99%   6
 100%  22 (longest request)
```

```
[base] daarso@daarso-GP62-7RE:~$ ab -n 20000 -c 10 -l http://192.168.56.106/index.html
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Benchmarking 192.168.56.106 (be patient)
Completed 2000 requests
Completed 4000 requests
Completed 6000 requests
Completed 8000 requests
Completed 10000 requests
Completed 12000 requests
Completed 14000 requests
Completed 16000 requests
Completed 18000 requests
Completed 20000 requests
Finished 20000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 6.401 seconds
Complete requests:   20000
Failed requests:    0
Total transferred:  7093334 bytes
HTML transferred:  1713334 bytes
Requests per second: 3124.53 [#/sec] (mean)
Time per request:   0.320 [ms] (mean)
Time per request:   0.320 [ms] (mean, across all concurrent requests)
Transfer rate:       1082.19 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.1      0    2
Processing:    1    3  1.0      3   16
Waiting:       1    3  1.0      3   16
Total:         1    3  1.0      3   16

Percentage of the requests served within a certain time (ms)
  50%   3
  66%   3
  75%   4
  80%   4
  90%   4
  95%   5
  98%   6
  99%   7
 100%  16 (longest request)
```

```
[base] daarso@daarso-GP62-7RE:~$ ab -n 25000 -c 10 -l http://192.168.56.106/index.html
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Benchmarking 192.168.56.106 (be patient)
Completed 2500 requests
Completed 5000 requests
Completed 7500 requests
Completed 10000 requests
Completed 12500 requests
Completed 15000 requests
Completed 17500 requests
Completed 20000 requests
Completed 22500 requests
Completed 25000 requests
Finished 25000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          80

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 8.151 seconds
Complete requests:   25000
Failed requests:    0
Total transferred:  8866668 bytes
HTML transferred:  2141668 bytes
Requests per second: 3066.97 [#/sec] (mean)
Time per request:   0.321 [ms] (mean)
Time per request:   0.326 [ms] (mean, across all concurrent requests)
Transfer rate:       1062.26 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.1      0    2
Processing:    1    3  3.4      3  166
Waiting:       1    3  1.1      3   19
Total:         1    3  3.4      3  166

Percentage of the requests served within a certain time (ms)
  50%   3
  66%   3
  75%   4
  80%   4
  90%   4
  95%   5
  98%   6
  99%   7
 100%  166 (longest request)
```

## ◆ Gobetween:

### Algoritmo Round-Robin:

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 10000 -c 10 -l http://192.168.56.106:2000/index.html
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Benchmarking 192.168.56.106 (be patient)
Completed 1000 requests
Completed 2000 requests
Completed 3000 requests
Completed 4000 requests
Completed 5000 requests
Completed 6000 requests
Completed 7000 requests
Completed 8000 requests
Completed 9000 requests
Completed 10000 requests
Finished 10000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          2000

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 6.294 seconds
Complete requests:   10000
Failed requests:    0
Total transferred:  3550040 bytes
HTML transferred:   860040 bytes
Requests per second: 1588.78 [/sec] (mean)
Time per request:   0.629 [ms] (mean, across all concurrent requests)
Transfer rate:       550.81 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0.1    0     5
Processing:    1    6.7.1    5   191
Waiting:       0    6.2.7    5    33
Total:         1    6.7.1    5   191

Percentage of the requests served within a certain time (ms)
 50%   5
 66%   6
 75%   7
 80%   8
 90%  10
 95%  11
 98%  13
 99%  15
100% 191 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 15000 -c 10 -l http://192.168.56.106:2000/index.html
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Benchmarking 192.168.56.106 (be patient)
Completed 1500 requests
Completed 3000 requests
Completed 4500 requests
Completed 6000 requests
Completed 7500 requests
Completed 9000 requests
Completed 10500 requests
Completed 12000 requests
Completed 13500 requests
Completed 15000 requests
Finished 15000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          2000

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 9.132 seconds
Complete requests:   15000
Failed requests:    0
Total transferred:  5325056 bytes
HTML transferred:   1290056 bytes
Requests per second: 1642.50 [/sec] (mean)
Time per request:   0.608 [ms] (mean)
Time per request:   0.609 [ms] (mean, across all concurrent requests)
Transfer rate:       569.43 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0.1    0     2
Processing:    1    6.4.3    5   133
Waiting:       1    6.2.7    5    52
Total:         1    6.4.4    5   133

Percentage of the requests served within a certain time (ms)
 50%   5
 66%   6
 75%   7
 80%   8
 90%  10
 95%  11
 98%  13
 99%  14
100% 133 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 20000 -c 10 -l http://192.168.56.106:2000/index.html
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Benchmarking 192.168.56.106 (be patient)
Completed 2000 requests
Completed 4000 requests
Completed 6000 requests
Completed 8000 requests
Completed 10000 requests
Completed 12000 requests
Completed 14000 requests
Completed 16000 requests
Completed 18000 requests
Completed 20000 requests
Finished 20000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          2000

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 12.103 seconds
Complete requests:   20000
Failed requests:    0
Total transferred:  7099912 bytes
HTML transferred:   1719912 bytes
Requests per second: 1652.42 [/sec] (mean)
Time per request:   0.6052 [ms] (mean)
Time per request:   0.605 [ms] (mean, across all concurrent requests)
Transfer rate:       572.85 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0.1    0     4
Processing:    1    6.4.8    5   179
Waiting:       1    6.2.6    5    44
Total:         1    6.4.8    5   179

Percentage of the requests served within a certain time (ms)
 50%   5
 66%   6
 75%   7
 80%   8
 90%   9
 95%  11
 98%  12
 99%  14
100% 179 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 25000 -c 10 -l http://192.168.56.106:2000/index.html
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Benchmarking 192.168.56.106 (be patient)
Completed 2500 requests
Completed 5000 requests
Completed 7500 requests
Completed 10000 requests
Completed 12500 requests
Completed 15000 requests
Completed 17500 requests
Completed 20000 requests
Completed 22500 requests
Completed 25000 requests
finished 25000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          2000

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 15.692 seconds
Complete requests:   25000
Failed requests:    0
Total transferred:  8875022 bytes
HTML transferred:   2150022 bytes
Requests per second: 1593.17 [/sec] (mean)
Time per request:   0.6277 [ms] (mean)
Time per request:   0.628 [ms] (mean, across all concurrent requests)
Transfer rate:       552.32 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0.1    0     4
Processing:    1    6.10.0    5   387
Waiting:       1    6.2.6    5    38
Total:         1    6.10.1    5   387

Percentage of the requests served within a certain time (ms)
 50%   5
 66%   6
 75%   7
 80%   8
 90%   9
 95%  11
 98%  12
 99%  14
100% 387 (longest request)
```

## Algoritmo Ponderación:

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 10000 -c 10 -l http://192.168.56.106:2000/index.html
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Licensed to The Apache Software Foundation, http://www.apache.org/
Benchmarking 192.168.56.106 (be patient)
completed 1000 requests
completed 2000 requests
completed 3000 requests
completed 4000 requests
completed 5000 requests
completed 6000 requests
completed 7000 requests
completed 8000 requests
completed 9000 requests
completed 10000 requests
Finished 10000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          2000

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 6.040 seconds
Complete requests:   10000
Failed requests:    0
Total transferred:  3546762 bytes
HTML transferred:  856762 bytes
Requests per second: 1655.73 [#/sec] (mean)
Time per request:   6.048 [ms] (mean)
Time per request:   0.604 [ms] (mean, across all concurrent requests)
Transfer rate:       573.48 [Kbytes/sec] received

connection Times (ms)
      min  mean[+/-sd] median   max
Connect:      0    0.1    0     8
Processing:   1    6.3.0    5     57
Waiting:     1    6.2.6    5     32
Total:       1    6.3.0    5     57

Percentage of the requests served within a certain time (ms)
  50%    5
  66%    6
  75%    7
  80%    8
  90%   10
  95%   11
  98%   13
  99%   14
100%  57 (longest request)

(base) daarso@daarso-GP62-7RE:~$ ab -n 15000 -c 10 -l http://192.168.56.106:2000/index.html
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Licensed to The Apache Software Foundation, http://www.apache.org/
Benchmarking 192.168.56.106 (be patient)
completed 1500 requests
completed 3000 requests
completed 4500 requests
completed 6000 requests
completed 7500 requests
completed 9000 requests
completed 10500 requests
Completed 12000 requests
Completed 13500 requests
Completed 15000 requests
finished 15000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          2000

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 9.038 seconds
Complete requests:   15000
Failed requests:    0
Total transferred:  5320138 bytes
HTML transferred: 1285138 bytes
Requests per second: 1659.66 [#/sec] (mean)
Time per request:   6.025 [ms] (mean)
Time per request:   0.603 [ms] (mean, across all concurrent requests)
Transfer rate:       574.84 [Kbytes/sec] received

connection Times (ms)
      min  mean[+/-sd] median   max
Connect:      0    0.1    0     5
Processing:   1    6.4.5    5     152
Waiting:     1    6.2.6    5     29
Total:       1    6.4.5    5     152

Percentage of the requests served within a certain time (ms)
  50%    5
  66%    6
  75%    7
  80%    8
  90%   10
  95%   11
  98%   12
  99%   14
100%  152 (longest request)

(base) daarso@daarso-GP62-7RE:~$ ab -n 20000 -c 10 -l http://192.168.56.106:2000/index.html
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Benchmarking 192.168.56.106 (be patient)
Completed 2000 requests
Completed 4000 requests
Completed 6000 requests
Completed 8000 requests
Completed 10000 requests
Completed 12000 requests
Completed 14000 requests
Completed 16000 requests
Completed 18000 requests
Completed 20000 requests
Finished 20000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          2000

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 12.072 seconds
Complete requests:   20000
Failed requests:    0
Total transferred:  7093164 bytes
HTML transferred: 1713164 bytes
Requests per second: 1656.70 [#/sec] (mean)
Time per request:   6.036 [ms] (mean)
Time per request:   0.604 [ms] (mean, across all concurrent requests)
Transfer rate:       573.79 [Kbytes/sec] received

connection Times (ms)
      min  mean[+/-sd] median   max
Connect:      0    0.1    0     5
Processing:   1    6.5.8    5    241
Waiting:     1    6.2.4    5     33
Total:       1    6.5.8    5    241

Percentage of the requests served within a certain time (ms)
  50%    5
  66%    6
  75%    7
  80%    8
  90%    9
  95%   11
  98%   12
  99%   13
100%  241 (longest request)

(base) daarso@daarso-GP62-7RE:~$ ab -n 25000 -c 10 -l http://192.168.56.106:2000/index.html
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Benchmarking 192.168.56.106 (be patient)
Completed 2500 requests
Completed 5000 requests
Completed 7500 requests
Completed 10000 requests
Completed 12500 requests
Completed 15000 requests
Completed 17500 requests
Completed 20000 requests
Completed 22500 requests
Completed 25000 requests
Finished 25000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          2000

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 16.018 seconds
Complete requests:   25000
Failed requests:    0
Total transferred:  8866924 bytes
HTML transferred: 2141924 bytes
Requests per second: 1560.74 [#/sec] (mean)
Time per request:   6.407 [ms] (mean)
Time per request:   0.641 [ms] (mean, across all concurrent requests)
Transfer rate:       540.59 [Kbytes/sec] received

connection Times (ms)
      min  mean[+/-sd] median   max
Connect:      0    0.1    0     11
Processing:   1    6.6.1    6    250
Waiting:     1    6.2.7    5     36
Total:       1    6.6.1    6    250

Percentage of the requests served within a certain time (ms)
  50%    6
  66%    7
  75%    7
  80%    8
  90%   10
  95%   12
  98%   13
  99%   15
100%  250 (longest request)
```

## ◆ Pound:

### Algoritmo sin Prioridad:

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 10000 -c 10 -l http://192.168.56.106:8081/index.html
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Benchmarking 192.168.56.106 (be patient)
Completed 1000 requests
Completed 2000 requests
Completed 3000 requests
Completed 4000 requests
Completed 5000 requests
Completed 6000 requests
Completed 7000 requests
Completed 8000 requests
Completed 9000 requests
Completed 10000 requests
Finished 10000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          8081

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 6.994 seconds
Complete requests:   10000
Failed requests:    0
Total transferred:  3549890 bytes
HTML transferred:   859890 bytes
Requests per second: 1429.79 [#/sec] (mean)
Time per request:   6.994 [ms] (mean)
Time per request:   0.699 [ms] (mean, across all concurrent requests)
Transfer rate:       495.66 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.0    0     1
Processing:    1    7  2.3    7    54
Waiting:       1    6  1.5    6    23
Total:         1    7  2.3    7    54

Percentage of the requests served within a certain time (ms)
  50%    7
  66%    7
  75%    8
  80%    8
  90%    9
  95%   10
  98%   11
  99%   14
 100%  54 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 15000 -c 10 -l http://192.168.56.106:8081/index.html
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Benchmarking 192.168.56.106 (be patient)
Completed 1500 requests
Completed 3000 requests
Completed 4500 requests
Completed 6000 requests
Completed 7500 requests
Completed 9000 requests
Completed 10500 requests
Completed 12000 requests
Completed 13500 requests
Completed 15000 requests
Finished 15000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          8081

Document Path:        /Index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 9.887 seconds
Complete requests:   15000
Failed requests:    0
Total transferred:  5325032 bytes
HTML transferred:   1290032 bytes
Requests per second: 1517.20 [#/sec] (mean)
Time per request:   6.591 [ns] (mean)
Time per request:   0.059 [ns] (mean, across all concurrent requests)
Transfer rate:       525.98 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.0    0     1
Processing:    1    7  2.7    6    59
Waiting:       1    5  1.2    5    47
Total:         1    7  2.7    6    59

Percentage of the requests served within a certain time (ms)
  50%    6
  66%    7
  75%    7
  80%    7
  90%    8
  95%    8
  98%    9
  99%   10
 100%  59 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 20000 -c 10 -l http://192.168.56.106:8081/index.html
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Benchmarking 192.168.56.106 (be patient)
Completed 2000 requests
Completed 4000 requests
Completed 6000 requests
Completed 8000 requests
Completed 10000 requests
Completed 12000 requests
Completed 14000 requests
Completed 16000 requests
Completed 18000 requests
Completed 20000 requests
Finished 20000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          8081

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 13.045 seconds
Complete requests:   20000
Failed requests:    0
Total transferred:  7100030 bytes
HTML transferred:   1720030 bytes
Requests per second: 1533.20 [#/sec] (mean)
Time per request:   6.522 [ms] (mean)
Time per request:   0.052 [ms] (mean, across all concurrent requests)
Transfer rate:       531.53 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.0    0     3
Processing:    1    6  1.7    6    50
Waiting:       1    5  1.1    5    21
Total:         2    7  1.7    6    50

Percentage of the requests served within a certain time (ms)
  50%    6
  66%    7
  75%    7
  80%    7
  90%    8
  95%    9
  98%   10
  99%   10
 100%  50 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 25000 -c 10 -l http://192.168.56.106:8081/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 2500 requests
Completed 5000 requests
Completed 7500 requests
Completed 10000 requests
Completed 12500 requests
Completed 15000 requests
Completed 17500 requests
Completed 20000 requests
Completed 22500 requests
Completed 25000 requests
Finished 25000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          8081

Document Path:        /Index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 17.226 seconds
Complete requests:   25000
Failed requests:    0
Total transferred:  8874888 bytes
HTML transferred:   2149888 bytes
Requests per second: 1451.31 [#/sec] (mean)
Time per request:   6.890 [ns] (mean)
Time per request:   0.089 [ns] (mean, across all concurrent requests)
Transfer rate:       503.13 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.1    0     4
Processing:    1    7  1.8    7    53
Waiting:       1    6  1.3    6    22
Total:         1    7  1.8    7    53

Percentage of the requests served within a certain time (ms)
  50%    7
  66%    7
  75%    8
  80%    8
  90%    9
  95%   10
  98%   11
  99%   12
 100%  53 (longest request)
```

## Algoritmo con Prioridad:

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 10000 -c 10 -l http://192.168.56.106:8081/index.html
This is ApacheBench, Version 2.3 <Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 1000 requests
Completed 2000 requests
Completed 3000 requests
Completed 4000 requests
Completed 5000 requests
Completed 6000 requests
Completed 7000 requests
Completed 8000 requests
Completed 9000 requests
Completed 10000 requests
Finished 10000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          8081

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 6.626 seconds
Complete requests:   10000
Failed requests:    0
Total transferred:  3546568 bytes
HTML transferred:  856568 bytes
Requests per second: 1509.14 #[/sec] (mean)
Time per request:   0.626 [ms] (mean)
Time per request:   0.663 [ms] (mean, across all concurrent requests)
Transfer rate:       522.68 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0.0      0     1
Processing:    1    7.1.4      6    35
Waiting:       1    6.1.2      5    34
Total:         1    7.1.4      6    35

Percentage of the requests served within a certain time (ms)
  50%   6
  66%   7
  75%   7
  80%   8
  90%   8
  95%   9
  98%   9
  99%  10
 100%  35 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 15000 -c 10 -l http://192.168.56.106:8081/index.html
This is ApacheBench, Version 2.3 <Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 1500 requests
Completed 3000 requests
Completed 4500 requests
Completed 6000 requests
Completed 7500 requests
Completed 9000 requests
Completed 10500 requests
Completed 12000 requests
Completed 13500 requests
Completed 15000 requests
Finished 15000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          8081

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 9.681 seconds
Complete requests:   15000
Failed requests:    0
Total transferred:  5320040 bytes
HTML transferred:  1285040 bytes
Requests per second: 1549.37 #[/sec] (mean)
Time per request:   0.645 [ms] (mean)
Time per request:   0.645 [ms] (mean, across all concurrent requests)
Transfer rate:       536.64 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0.0      0     1
Processing:    1    6.1.4      6    42
Waiting:       1    5.1.0      5    15
Total:         1    6.1.4      6    43

Percentage of the requests served within a certain time (ms)
  50%   6
  66%   7
  75%   7
  80%   7
  90%   8
  95%   8
  98%   9
  99%  10
 100%  43 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 20000 -c 10 -l http://192.168.56.106:8081/index.html
This is ApacheBench, Version 2.3 <Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 2000 requests
Completed 4000 requests
Completed 6000 requests
Completed 8000 requests
Completed 10000 requests
Completed 12000 requests
Completed 14000 requests
Completed 16000 requests
Completed 18000 requests
Completed 20000 requests
Finished 20000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          8081

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 12.634 seconds
Complete requests:   20000
Failed requests:    0
Total transferred:  7093352 bytes
HTML transferred:  1713352 bytes
Requests per second: 1583.07 #[/sec] (mean)
Time per request:   6.317 [ms] (mean)
Time per request:   0.632 [ms] (mean, across all concurrent requests)
Transfer rate:       548.30 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0.0      0     1
Processing:    1    6.1.2      6    28
Waiting:       1    5.1.0      5    26
Total:         1    6.1.2      6    29

Percentage of the requests served within a certain time (ms)
  50%   6
  66%   7
  75%   7
  80%   7
  90%   8
  95%   8
  98%   9
  99%   9
 100%  29 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 25000 -c 10 -l http://192.168.56.106:8081/index.html
This is ApacheBench, Version 2.3 <Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 2500 requests
Completed 5000 requests
Completed 7500 requests
Completed 10000 requests
Completed 12500 requests
Completed 15000 requests
Completed 17500 requests
Completed 20000 requests
Completed 22500 requests
Completed 25000 requests
Finished 25000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.106
Server Port:          8081

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 16.371 seconds
Complete requests:   25000
Failed requests:    0
Total transferred:  8866576 bytes
HTML transferred:  2141576 bytes
Requests per second: 1527.07 #[/sec] (mean)
Time per request:   6.548 [ms] (mean)
Time per request:   0.655 [ms] (mean, across all concurrent requests)
Transfer rate:       528.90 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0.0      0.1    0     6
Processing:    1    6.1.5      6    87
Waiting:       1    5.1.2      5    81
Total:         1    7.1.5      6    87

Percentage of the requests served within a certain time (ms)
  50%   6
  66%   7
  75%   7
  80%   7
  90%   8
  95%   9
  98%   9
  99%  10
 100%  87 (longest request)
```

## ◆ Zevenet: Algoritmo Round-Robin:

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 10000 -c 10 -l http://192.168.56.110:443/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
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```

```
Benchmarking 192.168.56.110 (be patient)
Completed 1000 requests
Completed 2000 requests
Completed 3000 requests
Completed 4000 requests
Completed 5000 requests
Completed 6000 requests
Completed 7000 requests
Completed 8000 requests
Completed 9000 requests
Completed 10000 requests
Finished 10000 requests

Server Software: Apache/2.4.29
Server Hostname: 192.168.56.110
Server Port: 443

Document Path: /index.html
Document Length: Variable

Concurrency Level: 10
Time taken for tests: 1.929 seconds
Complete requests: 10000
Failed requests: 0
Total transferred: 3550000 bytes
HTML transferred: 860000 bytes
Requests per second: 5183.21 [#/sec] (mean)
Time per request: 1.929 [ms] (mean)
Time per request: 0.193 [ms] (mean, across all concurrent requests)
Transfer rate: 1796.91 [Kbytes/sec] received
```

```
Connection Times (ms)
min mean[+/-sd] median max
Connect: 0 0 0.3 0 6
Processing: 0 2 0.9 1 34
Waiting: 0 2 0.8 1 34
Total: 0 2 0.9 2 35
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% 2
90% 3
95% 3
99% 4
99.9% 4
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 15000 -c 10 -l http://192.168.56.110:443/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/
```

```
Benchmarking 192.168.56.110 (be patient)
Completed 1500 requests
Completed 3000 requests
Completed 4500 requests
Completed 6000 requests
Completed 7500 requests
Completed 9000 requests
Completed 10500 requests
Completed 12000 requests
Completed 13500 requests
Completed 15000 requests
Finished 15000 requests
```

```
Server Software: Apache/2.4.29
Server Hostname: 192.168.56.110
Server Port: 443

Document Path: /index.html
Document Length: Variable

Concurrency Level: 10
Time taken for tests: 2.842 seconds
Complete requests: 15000
Failed requests: 0
Total transferred: 5325000 bytes
HTML transferred: 1290000 bytes
Requests per second: 5277.73 [#/sec] (mean)
Time per request: 1.895 [ms] (mean)
Time per request: 0.189 [ms] (mean, across all concurrent requests)
Transfer rate: 1829.68 [Kbytes/sec] received
```

```
Connection Times (ms)
min mean[+/-sd] median max
Connect: 0 0 0.4 0 7
Processing: 0 2 0.8 1 11
Waiting: 0 1 0.8 1 11
Total: 0 2 0.9 2 14
WARNING: The median and mean for the processing 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% 3
98% 4
99% 5
99.9% 14 (longest request)
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 20000 -c 10 -l http://192.168.56.110:443/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
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```

```
Benchmarking 192.168.56.110 (be patient)
Completed 2000 requests
Completed 4000 requests
Completed 6000 requests
Completed 8000 requests
Completed 10000 requests
Completed 12000 requests
Completed 14000 requests
Completed 16000 requests
Completed 18000 requests
Completed 20000 requests
Finished 20000 requests
```

```
Server Software: Apache/2.4.29
Server Hostname: 192.168.56.110
Server Port: 443

Document Path: /index.html
Document Length: Variable

Concurrency Level: 10
Time taken for tests: 3.809 seconds
Complete requests: 20000
Failed requests: 0
Total transferred: 7100000 bytes
HTML transferred: 1720000 bytes
Requests per second: 5250.48 [#/sec] (mean)
Time per request: 1.905 [ms] (mean)
Time per request: 0.190 [ms] (mean, across all concurrent requests)
Transfer rate: 1820.23 [Kbytes/sec] received
```

```
Connection Times (ms)
min mean[+/-sd] median max
Connect: 0 0 0.3 0 7
Processing: 0 2 0.8 1 11
Waiting: 0 1 0.8 1 10
Total: 0 2 0.9 2 13
WARNING: The median and mean for the processing 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% 3
98% 4
99% 5
```

```
(base) daarso@daarso-GP62-7RE:~$ ab -n 25000 -c 10 -l http://192.168.56.110:443/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/
```

```
Benchmarking 192.168.56.110 (be patient)
Completed 2500 requests
Completed 5000 requests
Completed 7500 requests
Completed 10000 requests
Completed 12500 requests
Completed 15000 requests
Completed 17500 requests
Completed 20000 requests
Completed 22500 requests
Completed 25000 requests
Finished 25000 requests
```

```
Server Software: Apache/2.4.29
Server Hostname: 192.168.56.110
Server Port: 443

Document Path: /index.html
Document Length: Variable

Concurrency Level: 10
Time taken for tests: 5.434 seconds
Complete requests: 25000
Failed requests: 0
Total transferred: 8875000 bytes
HTML transferred: 2150000 bytes
Requests per second: 4601.03 [#/sec] (mean)
Time per request: 2.173 [ms] (mean)
Time per request: 0.217 [ms] (mean, across all concurrent requests)
Transfer rate: 1595.08 [Kbytes/sec] received
```

```
Connection Times (ms)
min mean[+/-sd] median max
Connect: 0 0 0.5 0 18
Processing: 0 2 1.1 2 20
Waiting: 0 2 1.0 1 20
Total: 0 2 1.2 2 20
```

```
Percentage of the requests served within a certain time (ms)
50% 2
66% 2
75% 3
80% 3
90% 3
95% 4
98% 5
99% 7
100% 20 (longest request)
```

## Algoritmo Ponderación:

```
(base) daarsod@daarso-GP62-7RE:~$ ab -n 10000 -c 10 -l http://192.168.56.110:443/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
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Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.110 (be patient)
Completed 1000 requests
Completed 2000 requests
Completed 3000 requests
Completed 4000 requests
Completed 5000 requests
Completed 6000 requests
Completed 7000 requests
Completed 8000 requests
Completed 9000 requests
Completed 10000 requests
Finished 10000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.110
Server Port:          443

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 2.298 seconds
Complete requests:   10000
Failed requests:    0
Total transferred:  3546598 bytes
HTML transferred:   856598 bytes
Requests per second: 4350.74 [#/sec] (mean)
Time per request:   2.298 [ms] (mean)
Time per request:   0.230 [ms] (mean, across all concurrent requests)
Transfer rate:       1506.87 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.3     0    5
Processing:    0    2  1.1     2    9
Waiting:       0    2  1.1     2    7
Total:         0    2  1.2     3   11

Percentage of the requests served within a certain time (ms)
  50%   3
  66%   3
  75%   3
  80%   3
  90%   4
  95%   4
  98%   5
  99%   5
100%  11 (longest request)

(base) daarsod@daarso-GP62-7RE:~$ ab -n 15000 -c 10 -l http://192.168.56.110:443/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.110 (be patient)
Completed 1500 requests
Completed 3000 requests
Completed 4500 requests
Completed 6000 requests
Completed 7500 requests
Completed 9000 requests
Completed 10500 requests
Completed 12000 requests
Completed 13500 requests
Completed 15000 requests
Finished 15000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.110
Server Port:          443

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 3.478 seconds
Complete requests:   15000
Failed requests:    0
Total transferred:  5319950 bytes
HTML transferred:   1284950 bytes
Requests per second: 4313.37 [#/sec] (mean)
Time per request:   2.318 [ms] (mean)
Time per request:   0.232 [ms] (mean, across all concurrent requests)
Transfer rate:       1493.94 [kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.3     0    7
Processing:    0    2  1.2     2   15
Waiting:       0    2  1.2     2   15
Total:         0    2  1.2     3   16

Percentage of the requests served within a certain time (ms)
  50%   3
  66%   3
  75%   3
  80%   3
  90%   4
  95%   4
  98%   5
  99%   5
100%  16 (longest request)

(base) daarsod@daarso-GP62-7RE:~$ ab -n 20000 -c 10 -l http://192.168.56.110:443/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.110 (be patient)
Completed 2000 requests
Completed 4000 requests
Completed 6000 requests
Completed 8000 requests
Completed 10000 requests
Completed 12000 requests
Completed 14000 requests
Completed 16000 requests
Completed 18000 requests
Completed 20000 requests
Finished 20000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.110
Server Port:          443

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 4.603 seconds
Complete requests:   20000
Failed requests:    0
Total transferred:  7093266 bytes
HTML transferred:   1713266 bytes
Requests per second: 4344.75 [#/sec] (mean)
Time per request:   2.302 [ms] (mean)
Time per request:   0.230 [ms] (mean, across all concurrent requests)
Transfer rate:       1504.81 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.3     0    5
Processing:    0    2  1.1     2   12
Waiting:       0    2  1.1     2   12
Total:         0    2  1.2     3   14

Percentage of the requests served within a certain time (ms)
  50%   3
  66%   3
  75%   3
  80%   3
  90%   4
  95%   4
  98%   4
  99%   5
100%  14 (longest request)

(base) daarsod@daarso-GP62-7RE:~$ ab -n 25000 -c 10 -l http://192.168.56.110:443/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.110 (be patient)
Completed 2500 requests
Completed 5000 requests
Completed 7500 requests
Completed 10000 requests
Completed 12500 requests
Completed 15000 requests
Completed 17500 requests
Completed 20000 requests
Completed 22500 requests
Completed 25000 requests
Finished 25000 requests

Server Software:      Apache/2.4.29
Server Hostname:     192.168.56.110
Server Port:          443

Document Path:        /index.html
Document Length:     Variable

Concurrency Level:   10
Time taken for tests: 5.778 seconds
Complete requests:   25000
Failed requests:    0
Total transferred:  8866646 bytes
HTML transferred:   2141646 bytes
Requests per second: 4326.55 [#/sec] (mean)
Time per request:   2.311 [ms] (mean)
Time per request:   0.231 [ms] (mean, across all concurrent requests)
Transfer rate:       1498.51 [Kbytes/sec] received

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0  0.3     0   10
Processing:    0    2  1.2     2   15
Waiting:       0    2  1.2     2   15
Total:         0    2  1.2     3   16

Percentage of the requests served within a certain time (ms)
  50%   3
  66%   3
  75%   3
  80%   3
  90%   4
  95%   4
  98%   5
  99%   5
100%  16 (longest request)
```

## ■ Opciones Avanzadas AB:

Apache BenchMark nos presenta multitud de parámetros con los que poder medir el rendimiento de nuestro servidor. Algunos de ellos son los siguientes:

- ‘-t’: realiza el máximo número de peticiones en t segundos

```
(base) daarso@daarso-GP62-7RE:~$ ab -c 10 -t 5 http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 5000 requests
Completed 10000 requests
Completed 15000 requests
Finished 16028 requests

Server Software:        Apache/2.4.29
Server Hostname:        192.168.56.106
Server Port:            80

Document Path:          /index.html
Document Length:        85 bytes

Concurrency Level:      10
Time taken for tests:   5.000 seconds
Complete requests:      16028
Failed requests:         8045
    (Connect: 0, Receive: 0, Length: 8045, Exceptions: 0)
```

- ‘-w’: reproduce los datos en formato HTML

```
(base) daarso@daarso-GP62-7RE:~$ ab -c 10 -t 5 -w http://192.168.56.106/index.html
<p>
  This is ApacheBench, Version 2.3 <i>&lt;$Revision: 1807734 $&gt;</i><br>
  Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/<br>
  Licensed to The Apache Software Foundation, http://www.apache.org/<br>
</p>
<p>
Completed 5000 requests
Completed 10000 requests
Completed 15000 requests
Finished 15739 requests

<table>
<tr ><th colspan=2 bgcolor=white>Server Software:</th><td colspan=2 bgcolor=white>Apache/2.4.29</td></tr>
<tr ><th colspan=2 bgcolor=white>Server Hostname:</th><td colspan=2 bgcolor=white>192.168.56.106</td></tr>
<tr ><th colspan=2 bgcolor=white>Server Port:</th><td colspan=2 bgcolor=white>80</td></tr>
<tr ><th colspan=2 bgcolor=white>Document Path:</th><td colspan=2 bgcolor=white>/index.html</td></tr>
<tr ><th colspan=2 bgcolor=white>Document Length:</th><td colspan=2 bgcolor=white>85 bytes</td></tr>
<tr ><th colspan=2 bgcolor=white>Concurrency Level:</th><td colspan=2 bgcolor=white>10</td></tr>
<tr ><th colspan=2 bgcolor=white>Time taken for tests:</th><td colspan=2 bgcolor=white>5.000 seconds</td></tr>
<tr ><th colspan=2 bgcolor=white>Complete requests:</th><td colspan=2 bgcolor=white>15739</td></tr>
<tr ><th colspan=2 bgcolor=white>Failed requests:</th><td colspan=2 bgcolor=white>7935</td></tr>
<tr ><td colspan=4 bgcolor=white > (Connect: 0, Length: 7935, Exceptions: 0)</td></tr>
<tr ><th colspan=2 bgcolor=white>Total transferred:</th><td colspan=2 bgcolor=white>5587476 bytes</td></tr>
<tr ><th colspan=2 bgcolor=white>HTML transferred:</th><td colspan=2 bgcolor=white>1353685 bytes</td></tr>
<tr ><th colspan=2 bgcolor=white>Requests per second:</th><td colspan=2 bgcolor=white>3147.76</td></tr>
<tr ><th colspan=2 bgcolor=white>Transfer rate:</th><td colspan=2 bgcolor=white>1091.29 kb/s received</td></tr>
<tr ><th colspan=4 bgcolor=white>Connnection Times (ms)</th></tr>
<tr ><th bgcolor=white>&nbsp;</th> <th bgcolor=white>min</th> <th bgcolor=white>avg</th> <th bgcolor=white>max</th></tr>
<tr ><th bgcolor=white>Connect:</th><td bgcolor=white> 0</td><td bgcolor=white> 0</td><td bgcolor=white> 4</td></tr>
<tr ><th bgcolor=white>Processing:</th><td bgcolor=white> 1</td><td bgcolor=white> 3</td><td bgcolor=white> 14</td></tr>
<tr ><th bgcolor=white>Total:</th><td bgcolor=white> 1</td><td bgcolor=white> 3</td><td bgcolor=white> 18</td></tr>
</table>
```

- ‘-i’: envía peticiones de tipo HEAD en vez de GET

```
(base) daarso@daarso-GP62-7RE:~$ ab -c 10 -t 5 -i http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 5000 requests
Completed 10000 requests
Completed 15000 requests
Finished 15615 requests

Server Software:        Apache/2.4.29
Server Hostname:       192.168.56.106
Server Port:            80

Document Path:          /index.html
Document Length:        0 bytes

Concurrency Level:      10
Time taken for tests:   5.000 seconds
Complete requests:      15615
Failed requests:         0
Total transferred:      4200973 bytes
HTML transferred:       0 bytes
Requests per second:   3122.84 [#/sec] (mean)
Time per request:       3.202 [ms] (mean)
Time per request:       0.320 [ms] (mean, across all concurrent requests)
Transfer rate:          820.46 [Kbytes/sec] received
```

- ‘-k’: Activa HTTP KeepAlive, realiza multiples peticiones en una sola sesión de HTTP

```
(base) daarso@daarso-GP62-7RE:~$ ab -c 10 -t 5 -k http://192.168.56.106/index.html
This is ApacheBench, Version 2.3 <$Revision: 1807734 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking 192.168.56.106 (be patient)
Completed 5000 requests
Completed 10000 requests
Completed 15000 requests
Completed 20000 requests
Completed 25000 requests
Completed 30000 requests
Completed 35000 requests
Completed 40000 requests
Completed 45000 requests
Completed 50000 requests
Finished 50000 requests

Server Software:        Apache/2.4.29
Server Hostname:       192.168.56.106
Server Port:            80

Document Path:          /index.html
Document Length:        85 bytes

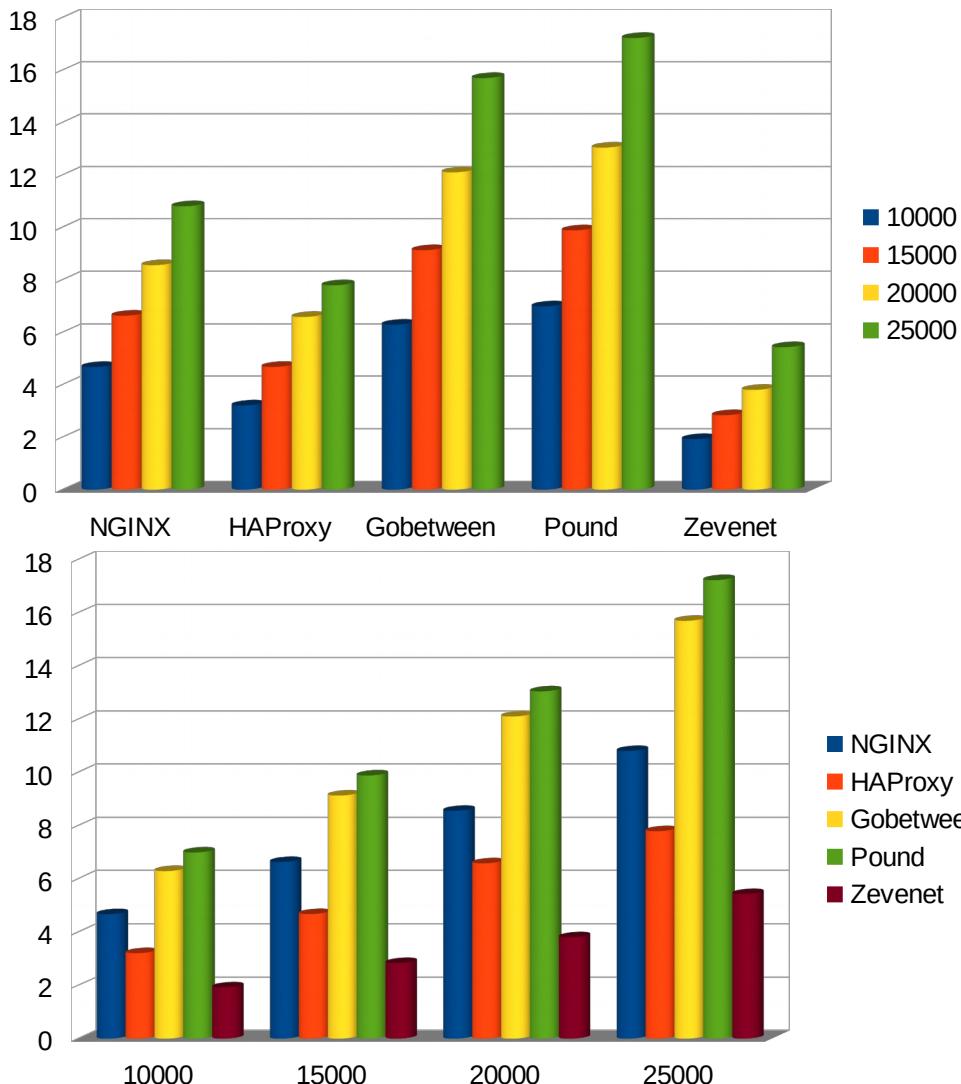
Concurrency Level:      10
Time taken for tests:   4.470 seconds
Complete requests:      50000
Failed requests:         25151
    (Connect: 0, Receive: 0, Length: 25151, Exceptions: 0)
Keep-Alive requests:    49510
```

## 8. Análisis comparativo en base a la carga de Apache Benchmark

Usando los datos obtenidos en el apartado anterior, realizaré un estudio comparativo de los distintos balanceadores haciendo distinción de los dos algoritmos utilizados. En las siguientes tablas se presentan los tiempos obtenidos:

### Algoritmo Round-Robin/sin prioridad:

N.º Peticiones	10000	15000	20000	25000
<b>NGINX</b>	4,677	6,636	8,561	10,808
<b>HAProxy</b>	3,212	4,683	6,587	7,794
<b>Gobetween</b>	6,294	9,132	12,103	15,695
<b>Pound</b>	6,994	9,887	13,045	17,226
<b>Zevenet</b>	1,929	2,842	3,809	5,434

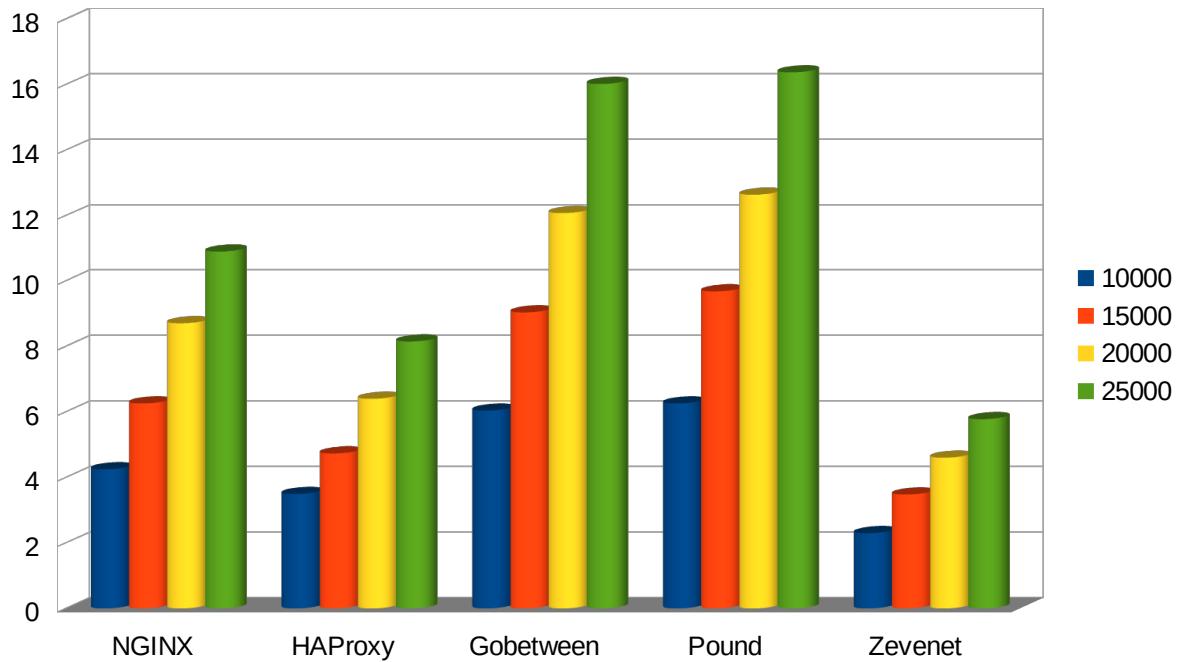


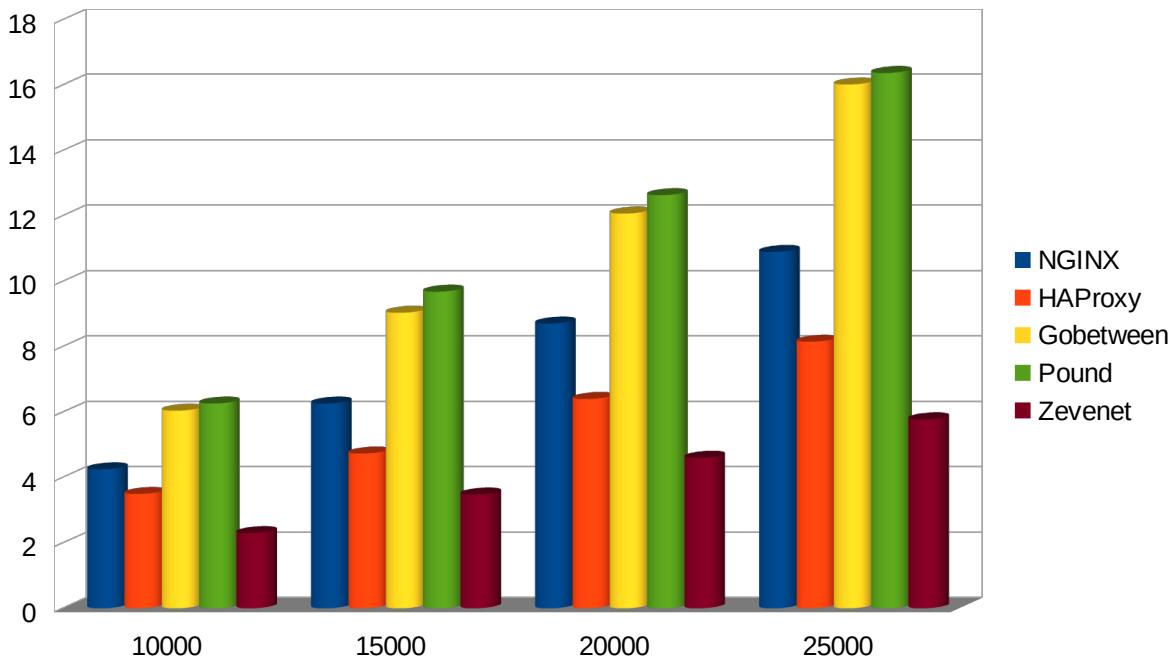
Después de realizar el estudio con el algoritmo Round-Robin con 10000, 15000, 20000, 250000 peticiones HTTP y elaborar la tabla de tiempos y los distintos gráficos, estoy en disposición de realizar un ranking en cuanto a tiempos:

- 1º Zevenet
- 2º HAProxy
- 3º Nginx
- 4º Gobetween
- 5º Pound

#### Algoritmo Ponderación/con prioridad:

N.º Peticiones	10000	15000	20000	25000
<b>NGINX</b>	4,250	6,260	8,707	10,898
<b>HAProxy</b>	3,495	4,732	6,401	8,151
<b>Gobetween</b>	6,04	9,038	12,072	16,018
<b>Pound</b>	6,262	9,681	12,634	16,371
<b>Zevenet</b>	2,298	3,478	4,603	5,778





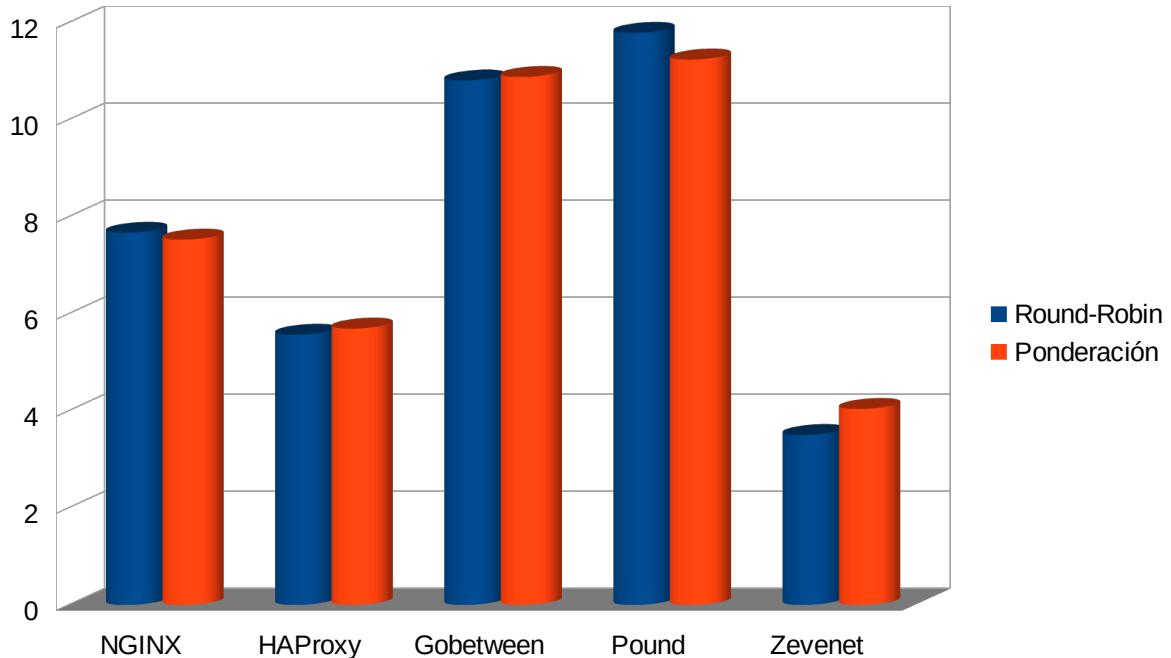
Después de realizar el estudio con el algoritmo Ponderación con 10000, 15000, 20000, 250000 peticiones HTTP y elaborar la tabla de tiempos y los distintos gráficos, estoy en disposición de realizar un ranking en cuanto a tiempos:

- 1º Zevenet
- 2º HAProxy
- 3º Nginx
- 4º Gobetween
- 5º Pound

#### Algoritmo Round-Robin vs Ponderación:

Para realizar el estudio, realizaré una media de los 4 tiempos obtenidos

Algoritmo	Round-Robin	Ponderación
<b>NGINX</b>	7,6705	7,528
<b>HAProxy</b>	5,569	5,694
<b>Gobetween</b>	10,806	10,88
<b>Pound</b>	11,788	11,237
<b>Zevenet</b>	3,503	4,039



Finalmente, concluimos que los datos no son concluyentes en cuanto a la mejoría de rendimiento debido a la distinta utilización de algoritmos. En mi opinión, esto es debido a que la carga de la granja web es poco elevada y por tanto no podemos tener certeza de que algoritmo utilizar. Para poder saberlo, tendríamos que enfrentarnos a un problema real con una carga mucho más elevada. En mi caso, se puede observar que **Nginx** y **Pound** tienen mejor rendimiento con el algoritmo de **ponderación** y **HAProxy**, **Gobetween** y **Zevenet** tienen mejores prestaciones con **Roud-Robin**.