



LAB WEEK 9

Triển khai hệ thống Load Balancing (HAProxy) cho webserver và database server

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MỤC TIÊU

Lab Week 9: Triển khai hệ thống Load Balancing (HAProxy) cho webserver và database server

1. Yêu cầu môi trường

- 4 máy chủ: Mỗi máy có 2 core CPU, 2GB RAM, 30GB SSD.
- Hệ điều hành (OS): Ubuntu 22.04.
- IP: Mỗi máy thuộc dải VPS, có 1 IP Public riêng (công khai để truy cập từ internet).

2. Thời gian

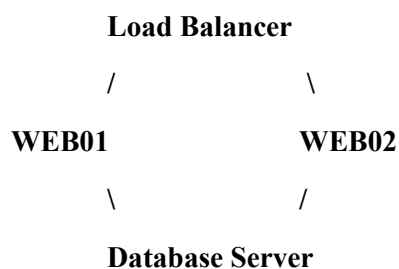
- 8h30 đến 16h00 để hoàn thành bài lab.
- Hình thức báo cáo: Báo cáo file kết quả sau khi làm bằng file PDF.
- Chương bị môi trường: Sử dụng VươngVD.
- Giao diện tài liệu: NghiTT.
- Khóa thực tập.

3. Đề bài

Triển khai hệ thống Load Balancing (HAProxy) cho webserver. Đảm bảo khi có bất kỳ server nào bị lỗi, hệ thống vẫn hoạt động bình thường mà không gây gián đoạn dịch vụ.

4. Mô hình

- Một Load Balancer (HAProxy) sẽ phân phối tải giữa 2 webserver (WEB01, WEB02) và 1 Database Server.
- Mô hình như sau:



5. Các bước thực hiện (Câu 1-4)

****Câu 1**:** Triển khai hệ thống webserver nginx trên 2 server WEB01 và WEB02. Đảm bảo source code khi upload lên WEB01 thì WEB02 sẽ được đồng bộ bằng `lsyncd`. (3 điểm)

****Câu 2**:** Triển khai Load Balancing bằng HAProxy trên Load Balancer. Cấu hình roundrobin và healthcheck để đảm bảo khi có bất kỳ server nào gặp sự cố thì hệ thống vẫn phục hồi ngay và không gây gián đoạn dịch vụ. (2 điểm)

****Câu 3**:** Triển khai cluster database MySQL Galera trên 3 server: WEB01, WEB02, và Database Server. Sau đó sử dụng Load Balancer để điều phối traffic cho bên ngoài kết nối vào database. (3 điểm)

****Câu 4**:** Tạo database và cài đặt 1 website WordPress đơn giản với database vừa tạo. Phân quyền cho database chỉ cho phép 5 địa chỉ IP sau truy cập:

- localhost
- 125.212.250.9
- 113.161.61.219
- WEB01
- WEB02

(2 điểm)

**Triển khai từng bước**

**Chuẩn bị trước khi bắt đầu**

1. **Hiểu vai trò của từng máy:**

- ****Load Balancer****: Cài HAProxy để phân phối tải.
- ****WEB01, WEB02****: Cài webserver (Apache/Nginx) để chạy website.
- ****Database Server****: Cài MySQL để lưu trữ dữ liệu.

2. **IP của các máy**: Bạn cần gán IP cụ thể cho từng máy. Vì đề bài không cung cấp IP thực tế, tôi sẽ giả định:

- Load Balancer: 192.168.1.10
- WEB01: 192.168.1.11
- WEB02: 192.168.1.12
- Database Server: 192.168.1.13

3. **Cài đặt cơ bản**:

- Cài Ubuntu 22.04 trên cả 4 máy.
- Cập nhật hệ thống:

```
``bash
```

```
sudo apt update && sudo apt upgrade -y
```

CHUẨN BỊ BAN ĐẦU

IP Public hiện tại

- Load Balancer (lb): 103.27.61.30/25
- WEB01 (web1): 103.27.61.10/25
- WEB02 (web2): 45.122.223.43/25
- Database Server (db): 45.122.223.47/25

Yêu cầu Private IP

- Dải IP: 192.168.x.1 - 192.168.x.4, với Subnet: /24.
- x là số cuối của IP Public của Load Balancer.
- IP Public của Load Balancer là 103.27.61.30, nên x = 30.
- Do đó, dải Private IP sẽ là: 192.168.30.1 - 192.168.30.4/24.

Phân bổ Private IP

- Load Balancer: 192.168.30.1/24
- WEB01: 192.168.30.2/24
- WEB02: 192.168.30.3/24
- Database Server: 192.168.30.4/24

Giao diện cần cấu hình

- Tất cả các máy đều có giao diện ens19 (hiện đang ở trạng thái DOWN).
- Chúng ta sẽ kích hoạt ens19 và gán Private IP cho giao diện này.

- Cấu hình IP hiện tại chưa có Privated IP:

```
root@lb:~# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 88:b6:e5:9b:0b:b2 brd ff:ff:ff:ff:ff:ff
    altname enp0s18
    inet 193.27.61.30/25 brd 193.27.61.127 scope global eth0
        valid_lft forever preferred_lft forever
    inet6 fe80::8ab6:e5ff:fe9b:0b2/64 scope link
        valid_lft forever preferred_lft forever
3: ens19: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN group default qlen 1000
    link/ether 46:65:22:b5:ad:44 brd ff:ff:ff:ff:ff:ff
    altname enp0s19
root@lb:~#

root@web1:~# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 9c:8d:c8:9e:56:f1 brd ff:ff:ff:ff:ff:ff
    altname enp0s18
    inet 193.27.61.10/25 brd 193.27.61.127 scope global eth0
        valid_lft forever preferred_lft forever
    inet6 fe80::9c8d:c8ff:fe9e:56f1/64 scope link
        valid_lft forever preferred_lft forever
3: ens19: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN group default qlen 1000
    link/ether 9a:75:a3:d7:57:27 brd ff:ff:ff:ff:ff:ff
    altname enp0s19
root@web1:~#

root@web2:~# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 28:9a:b1:1b:d2:2b brd ff:ff:ff:ff:ff:ff
    altname enp0s18
    inet 45.122.223.43/25 brd 45.122.223.127 scope global eth0
        valid_lft forever preferred_lft forever
    inet6 fe80::229a:b1ff:fe1b:d22b/64 scope link
        valid_lft forever preferred_lft forever
3: ens19: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN group default qlen 1000
    link/ether 52:01:a6:1f:15:ca brd ff:ff:ff:ff:ff:ff
    altname enp0s19
root@web2:~#

root@db:~# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether f8:b4:78:a9:32:5c brd ff:ff:ff:ff:ff:ff
    altname enp0s18
    inet 45.122.223.47/25 brd 45.122.223.127 scope global eth0
        valid_lft forever preferred_lft forever
    inet6 fe80::fab4:78ff:fea9:325c/64 scope link
        valid_lft forever preferred_lft forever
3: ens19: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN group default qlen 1000
    link/ether 56:a1:78:2c:12:85 brd ff:ff:ff:ff:ff:ff
    altname enp0s19
root@db:~#
```

* Thiết lập Privated IP:

- Trên Load Balancer (lb)

- Kết quả sau khi thêm IP và đã ping thông được với nhau:

- Chỉnh sửa lần lượt file cấu hình này trên 4 VM:

nano /etc/netplan/50-cloud-init.yaml

- Thêm cấu hình cho ens19 trong file netplan :

+ Trên Load Balancer (lb)

ens19:

addresses:

- 192.168.30.1/24

+ Trên WEB01 (web1)

ens19:

addresses:

- 192.168.30.2/24

+ Trên WEB02 (web2)

ens19:

addresses:

- 192.168.30.3/24

+ Trên Database Server (db)

ens19:

addresses:

- 192.168.30.3/24

- Chạy lệnh áp dụng cấu hình này trên 4 VM: netplan apply

- Kết quả sau khi set thành công, các IP privated đã ping được với nhau

```
root@b3 ~# cat /etc/passwd | grep root | cut -d: -f1 | xargs -I {} ssh {} root@wsl1 -t
valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
link/ether 8b:6e:09:b0:bd:b2 bd ff:ff:ff:ff:ff:ff
altname empb3s
altname ens10
inet 103.27.61.30/25 brd 103.27.61.127 scope global eth0
valid_lft forever preferred_lft forever
inet fe80::b4b6:e0ff:fe9b:1b61/64 scope link
valid_lft forever preferred_lft forever
3: ens19: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
link/ether 56:55:52:b6:4b:4d bd ff:ff:ff:ff:ff:ff
altname empb3s
altname ens19
inet 192.168.30.27/24 brd 192.168.30.255 scope global ens19
valid_lft forever preferred_lft forever
inet fe80::4465:22ff:feb5:ad14/64 scope link
valid_lft forever preferred_lft forever
root@b3 ~# ping 192.168.30.3
PING 192.168.30.4 (192.168.30.4) 56(84) bytes of data.
64 bytes from 192.168.30.4: icmp_seq=1 ttl=64 time=1.79 ms
--
-- 192.168.30.3 ping statistics --
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 1.790/1.794/1.794/0.000 ms
root@b3 ~#

root@wsl2 ~# cat /etc/passwd | grep root | cut -d: -f1 | xargs -I {} ssh {} root@wsl1 -t
valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
link/ether 20:9a:b1:b0:42:26 bd ff:ff:ff:ff:ff:ff
altname empb3s
altname ens10
inet 45.122.223.43/25 brd 45.122.223.127 scope global eth0
valid_lft forever preferred_lft forever
inet fe80::c29a:b1ff:b1b1:d220/64 scope link
valid_lft forever preferred_lft forever
3: ens19: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
link/ether 52:54:00:12:3b:82 bd ff:ff:ff:ff:ff:ff
altname empb3s
altname ens19
inet 192.168.30.37/24 brd 192.168.30.255 scope global ens19
valid_lft forever preferred_lft forever
inet fe80::5081:a6ff:fe15:c6/64 scope link
valid_lft forever preferred_lft forever
root@wsl2 ~# ping 192.168.30.1
PING 192.168.30.1 (192.168.30.1) 56(84) bytes of data.
64 bytes from 192.168.30.1: icmp_seq=1 ttl=64 time=1.97 ms
--
-- 192.168.30.1 ping statistics --
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 1.965/1.965/1.965/0.000 ms
root@wsl2 ~#

root@wsl1 ~# cat /etc/passwd | grep root | cut -d: -f1 | xargs -I {} ssh {} root@wsl2 -t
valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
link/ether f0:b1:79:a0:32:5c bd ff:ff:ff:ff:ff:ff
altname empb3s
altname ens10
inet 45.122.223.47/25 brd 45.122.223.127 scope global eth0
valid_lft forever preferred_lft forever
inet fe80::f4b1:79ff:feab:325c/64 scope link
valid_lft forever preferred_lft forever
3: ens19: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
link/ether 56:51:79:3c:3c:35 bd ff:ff:ff:ff:ff:ff
altname empb3s
altname ens19
inet 192.168.30.47/24 brd 192.168.30.255 scope global ens19
valid_lft forever preferred_lft forever
inet fe80::54a1:7bff:fe2c:1285/64 scope link
valid_lft forever preferred_lft forever
root@wsl1 ~# ping 192.168.30.2
PING 192.168.30.2 (192.168.30.2) 56(84) bytes of data.
64 bytes from 192.168.30.2: icmp_seq=1 ttl=64 time=1.79 ms
--
-- 192.168.30.2 ping statistics --
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 1.790/1.790/1.790/0.000 ms
root@wsl1 ~#
```


Phần 1. Triển khai webserver trên WEB01 và WEB02 (Câu 1)

- Triển khai hệ thống webserver nginx trên 2 server WEB01 và WEB02. Đảm bảo source code khi upload lên WEB01 thì WEB02 sẽ được đồng bộ bằng 'lsyncd'. (3 điểm)

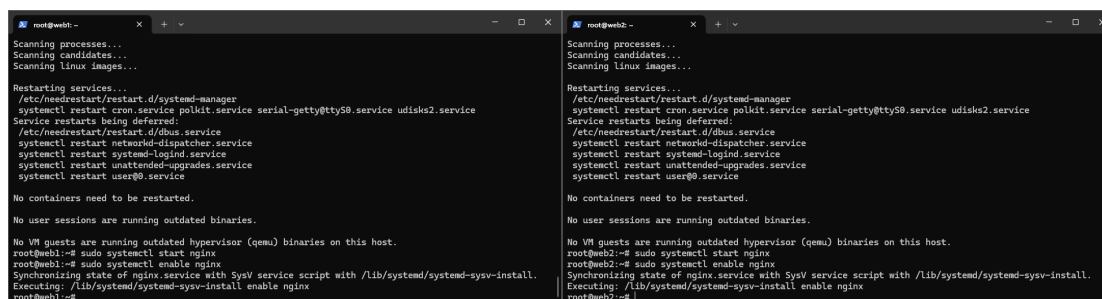
1.1 Cài đặt Nginx

- Cài Nginx trên cả WEB01 và WEB02:

`sudo apt install nginx -y`

`sudo systemctl start nginx` (Khởi động)

`sudo systemctl enable nginx` (Bật tự khởi động lại khi reboot)



The image shows two terminal windows side-by-side. The left window is for root@web1 and the right window is for root@web2. Both windows show the same sequence of commands: scanning processes, restarting services, and then installing and enabling Nginx. The output for both is identical, showing that Nginx is successfully installed and enabled on both servers.

```
root@web1:~# sudo systemctl start nginx
root@web1:~# sudo systemctl enable nginx
Synchronizing state of nginx.service with SysV service script with /lib/systemd/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install enable nginx
root@web1:~#
```

```
root@web2:~# sudo systemctl start nginx
root@web2:~# sudo systemctl enable nginx
Synchronizing state of nginx.service with SysV service script with /lib/systemd/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install enable nginx
root@web2:~#
```

1.2 Đồng bộ source code bằng lsyncd và kiểm tra

- Trên WEB01, cấu hình lsyncd để đồng bộ với WEB02 qua Private IP:

`sudo apt install lsyncd -y`

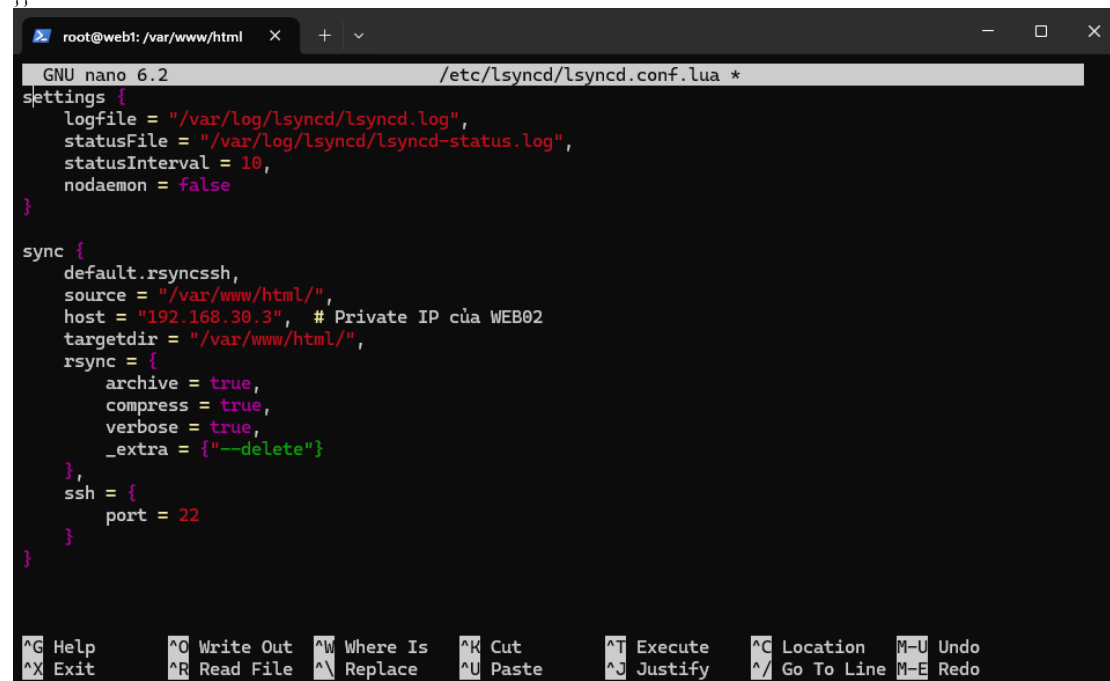
- Trên WEB01, tạo thư mục /etc/lsyncd:

`sudo mkdir -p /etc/lsyncd`

- Cấu hình: `sudo nano /etc/rsyncd/rsyncd.conf.lua`

```
settings {  
  
    logfile = "/var/log/rsyncd/rsyncd.log",  
  
    statusFile = "/var/log/rsyncd/rsyncd-status.log",  
  
    statusInterval = 10,  
  
    nodaemon = false  
}
```

```
sync {  
  
    default.rsyncssh,  
  
    source = "/var/www/html/",  
  
    host = "192.168.30.3", # Private IP của WEB02  
  
    targetdir = "/var/www/html/",  
  
    rsync = {  
  
        archive = true,  
  
        compress = true,  
  
        verbose = true,  
  
        _extra = {"--delete"}  
    },  
  
    ssh = {  
  
        port = 22  
    }  
}
```



```
GNU nano 6.2 /etc/rsyncd/rsyncd.conf.lua *  
settings {  
    logfile = "/var/log/rsyncd/rsyncd.log",  
    statusFile = "/var/log/rsyncd/rsyncd-status.log",  
    statusInterval = 10,  
    nodaemon = false  
}  
  
sync {  
    default.rsyncssh,  
    source = "/var/www/html/",  
    host = "192.168.30.3", # Private IP của WEB02  
    targetdir = "/var/www/html/",  
    rsync = {  
        archive = true,  
        compress = true,  
        verbose = true,  
        _extra = {"--delete"}  
    },  
    ssh = {  
        port = 22  
    }  
}
```

- Bật rsync:

```
root@web1: ~
GNU nano 6.2 /etc/default/rsync *
# defaults file for rsync daemon mode
#
# This file is only used for init.d based systems!
# If this system uses systemd, you can specify options etc. for rsync
# in daemon mode by copying /lib/systemd/system/rsync.service to
# /etc/systemd/system/rsync.service and modifying the copy; add required
# options to the ExecStart line.
#
# start rsync in daemon mode from init.d script?
# only allowed values are "true", "false", and "inetd"
# Use "inetd" if you want to start the rsyncd from inetd,
# all this does is prevent the init.d script from printing a message
# about not starting rsyncd (you still need to modify inetd's config yourself).
RSYNC_ENABLE=true
#
# which file should be used as the configuration file for rsync.
# This file is used instead of the default /etc/rsyncd.conf
# Warning: This option has no effect if the daemon is accessed
# using a remote shell. When using a different file for
# rsync you might want to symlink /etc/rsyncd.conf to
# that file.
# RSYNC_CONFIG_FILE=
#
# what extra options to give rsync --daemon?
# that excludes the --daemon; that's always done in the init.d script
# Possibilities are:
^G Help      ^O Write Out  ^W Where Is   ^K Cut        ^T Execute    ^C Location   M-U Undo
^X Exit      ^R Read File  ^\ Replace    ^U Paste      ^J Justify    ^_ Go To Line  M-E Redo
```

- Cấu hình SSH(vì lsyncd dùng giao thức này để đồng bộ file):

ssh-keygen -t rsa

ssh-copy-id root@192.168.30.3

```
root@web1: ~  
|  o + o o = + . |  
|  = . . . + o |  
|  . o . . . |  
|  o..E |  
+-----[SHA256]-----+  
root@web1:~# ssh-copy-id root@192.168.30.3  
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/root/.ssh/id_rsa.pub"  
The authenticity of host '192.168.30.3 (192.168.30.3)' can't be established.  
ED25519 key fingerprint is SHA256:hee9H1hLK4/YW3C/+TKFZPELiXsNTf/Wlpj67R03lEo.  
This key is not known by any other names  
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes  
Please type 'yes', 'no' or the fingerprint: yes  
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed  
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys  
root@192.168.30.3's password:  
  
Number of key(s) added: 1  
  
Now try logging into the machine, with: "ssh 'root@192.168.30.3'"  
and check to make sure that only the key(s) you wanted were added.  
root@web1:~#
```

- Kiểm tra đã có tại web2:

```
root@web2:~# cat ~/.ssh/authorized_keys  
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAQGDQZHF0QGuXxo5mrFg40eF6WCPxtPWZpG0tktUoUCSvzbzEyMAN3z4Szwfs50EAr0  
/R806FfDvmwZJLnMML/ID0AhauDzhdACY5kMcVBYw455MGe52gNISDj/IC0igv+Z/cv763MM/RMCyB0kyzbilWLS1i9H+rujFeW0EXZ  
x9H048GW9Yc7Dwg9XjHXuvmXZqLYmjj3p3LcmjURseCAHbs5uqjcrpYzToN08xNyBgD+nyA9zM9wgUB0n3YIzfXOMRvp6Co4SCCFg  
D01DpKqKkSN+L/1rbfD4PiePLtAZgK55UKdTzLZAc7+NjcHa5cyZ112CwvBzDjowwiUsl5Bt2QMIBC00MfgYIk/DWlb5r+sXaEvzm/  
NW52+6MbUJRyo5p6i2SUBpAEY1TiFF/J7uQj2Ef7auEDhC/izoapGvSyM/b4Ap+G2L0oQqF3BtgEL38PFEKQjB3d3sKpFXUmGBec1H  
gjdTcQXG577HzE+0IC0rCouqS51iGlq7Q6RSZTdUU= root@web1  
root@web2:~#
```

- Khởi động:

sudo systemctl start lsyncd

sudo systemctl enable lsyncd

```
root@web1:~# sudo systemctl start lsyncd  
root@web1:~# sudo systemctl enable lsyncd  
lsyncd.service is not a native service, redirecting to systemd-sysv-install.  
Executing: /lib/systemd/systemd-sysv-install enable lsyncd  
root@web1:~#
```

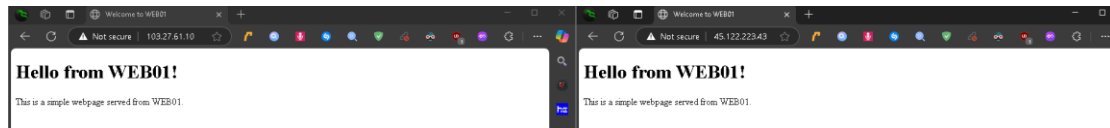
1.3 Đồng bộ source code bằng lsyncd và kiểm tra

- Tạo file source.py ở web 1, và web 2 sẽ được đồng bộ theo

```
root@web1: /var/www/html #
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
   link/loopback 08:00:00:00:00:00 brd 00:00:00:00:00:00
   inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
   inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
   link/ether 9c:8d:c8:9e:56:f1 brd ff:ff:ff:ff:ff:ff
   altname enp0s18
   inet 185.27.61.18/25 brd 185.27.61.127 scope global eth0
       valid_lft forever preferred_lft forever
   inet6 fe88::9e8d:c8ff:fe9e:56f1/64 scope link
       valid_lft forever preferred_lft forever
3: ens19: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
   link/ether 9a:75:a3:b7:57:27 brd ff:ff:ff:ff:ff:ff
   altname enp0s19
   inet 192.168.30.2/24 brd 192.168.30.255 scope global ens19
       valid_lft forever preferred_lft forever
   inet6 fe88::9a75:a3ff:feb7:5727/64 scope link
       valid_lft forever preferred_lft forever
root@web1: /var/www/html# touch source.py
root@web1: /var/www/html# ls
index.html  old_html  source.py
root@web1: /var/www/html#

root@web2: /var/www/html #
   valid_lft forever preferred_lft forever
   inet6 fe88::229a:b1ff:fe1b:d22b/64 scope link
       valid_lft forever preferred_lft forever
3: ens19: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
   link/ether 52:81:a6:1f:15:ca brd ff:ff:ff:ff:ff:ff
   altname enp0s19
   inet 192.168.30.3/24 brd 192.168.30.255 scope global ens19
       valid_lft forever preferred_lft forever
   inet6 fe88::5001:a6ff:fe1f:15ca/64 scope link
       valid_lft forever preferred_lft forever
root@web2: /var/www/html# curl 45.122.223.43
<!DOCTYPE html>
<html>
<head>
  <title>Welcome to WEB01</title>
</head>
<body>
  <h1>Hello from WEB01!</h1>
  <p>This is a simple webpage served from WEB01.</p>
</body>
</html>
root@web2: /var/www/html# ls
index.html  old_html  source.py
root@web2: /var/www/html#
```

- Cả 2 site đều cập nhật lại web khi có thay đổi:



Phần 2. Triển khai Load Balancing bằng HAProxy (Câu 2)

- Triển khai Load Balancing bằng HAProxy trên Load Balancer. Cấu hình roundrobin và healthcheck để đảm bảo khi có bất kỳ server nào gặp sự cố thì hệ thống vẫn phục hồi ngay và không gây gián đoạn dịch vụ. (2 điểm)

2.1 Cài HAProxy

- Cài đặt trên Load Balancer:

```
sudo apt install haproxy -y
```

```
sudo systemctl start haproxy
```

```
sudo systemctl enable haproxy
```

```
root@lb:~# sudo systemctl start haproxy
root@lb:~# sudo systemctl enable haproxy
Synchronizing state of haproxy.service with SysV service script with /lib/systemd/systemd-sysv-install
.
Executing: /lib/systemd/systemd-sysv-install enable haproxy
```

2.2 Cấu hình HAProxy

- Chỉnh sửa file cấu hình:

```
sudo nano /etc/haproxy/haproxy.cfg
```

theo cấu hình sau:

```
frontend http_front
```

```
    bind 0.0.0.0:80
```

```
    mode http
```

```
    option http-server-close
```

```
    option forwardfor
```

```
    default_backend http_back
```

```
backend http_back
```

```
    mode http
```

```
    balance roundrobin
```

```
    option httpchk GET / HTTP/1.1\r\nHost:\ localhost
```

```
    http-check connect
```

```
    http-check send meth GET uri /
```

```
    http-check expect status 200
```

```
    server web01 192.168.30.2:80 check inter 2000 rise 2 fall 3
```

```
    server web02 192.168.30.3:80 check inter 2000 rise 2 fall 3
```

```
root@lb: ~
GNU nano 6.2 /etc/haproxy/haproxy.cfg *
user haproxy
group haproxy
daemon

# Default SSL material locations
ca-base /etc/ssl/certs
crt-base /etc/ssl/private

# See: https://ssl-config.mozilla.org/#server=haproxy&server-version=2.0.3&config=intermediate
ssl-default-bind-ciphers ECDHE-ECDSA-AES128-GCM-SHA256:ECDHE-RSA-AES128-GCM-SHA256:ECDHE-ECDS
ssl-default-bind-ciphersuites TLS_AES_128_GCM_SHA256:TLS_AES_256_GCM_SHA384:TLS_CHACHA20_POLY
ssl-default-bind-options ssl-min-ver TLSv1.2 no-tls-tickets

defaults
    log global
    mode http
    option httplog
    option dontlognull
    timeout connect 5000
    timeout client 50000
    timeout server 50000
    errorfile 400 /etc/haproxy/errors/400.http
    errorfile 403 /etc/haproxy/errors/403.http
    errorfile 408 /etc/haproxy/errors/408.http
    errorfile 500 /etc/haproxy/errors/500.http
    errorfile 502 /etc/haproxy/errors/502.http
    errorfile 503 /etc/haproxy/errors/503.http
    errorfile 504 /etc/haproxy/errors/504.http

frontend http_front
    bind 0.0.0.0:80
    mode http
    option http-server-close
    option forwardfor
    default_backend http_back

backend http_back
    mode http
    balance roundrobin
    option httpchk GET / HTTP/1.1\r\nHost:\ localhost
    http-check connect
    http-check send meth GET uri /
    http-check expect status 200
    server web01 192.168.30.2:80 check inter 2000 rise 2 fall 3
    server web02 192.168.30.3:80 check inter 2000 rise 2 fall 3

^G Help      ^O Write Out  ^W Where Is   ^K Cut         ^J Execute    ^C Location   M-U Undo
^X Exit      ^R Read File  ^_ Replace    ^U Paste       ^_ Justify    ^_ Go To Line M-E Redo
```

- Kiểm tra cú pháp:

```
sudo haproxy -c -f /etc/haproxy/haproxy.cfg
```

- Khởi động:

```
root@lb:~# sudo systemctl restart haproxy
```

```
root@lb:~# sudo systemctl enable haproxy
```

```
root@lb:~# sudo nano /etc/haproxy/haproxy.cfg
root@lb:~#
root@lb:~# sudo haproxy -c -f /etc/haproxy/haproxy.cfg
[WARNING] (29435) : parsing [/etc/haproxy/haproxy.cfg:47]: 'option httpchk' : hiding headers or body
at the end of the version string is deprecated. Please, consider to use 'http-check send' directive in
stead.
Warnings were found.
Configuration file is valid
root@lb:~# sudo systemctl restart haproxy
root@lb:~# sudo systemctl enable haproxy
Synchronizing state of haproxy.service with SysV service script with /lib/systemd/systemd-sysv-install
.
Executing: /lib/systemd/systemd-sysv-install enable haproxy
```

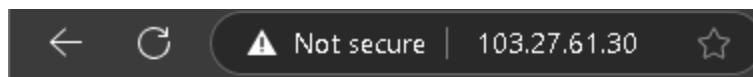
2.3 Kiểm tra

- Truy cập IP Public của Load Balancer (103.27.61.30) trên trình duyệt và liên tục reload. Sẽ thấy nội dung từ WEB01 hoặc WEB02 luân phiên.



Hello from WEB01!

This is a simple webpage served from WEB01.



Hello from WEB02!

This is a simple webpage served from WEB01.

Phần 3. Triển khai MySQL Galera Cluster (Câu 3)

- Triển khai cluster database MySQL Galera trên 3 server: WEB01, WEB02, và Database Server. Sau đó sử dụng Load Balancer để điều phối traffic cho bên ngoài kết nối vào database. (3 điểm)

3.1 Tải về MariaDB + Galera

- MySQL Galera trên Ubuntu 24.04 yêu cầu thêm repository chính thức. Thực hiện trên WEB01, WEB02, và Database Server:

```
sudo apt install mariadb-server galera-4 -y
```

3.2 Cấu hình MariaDB Galera

- Trên **WEB01**:

```
sudo nano /etc/mysql/mariadb.conf.d/60-galera.cnf
```

- Nội dung:

```
[galera]
```

```
# Mandatory settings
```

```
wsrep_on=ON
```

```
wsrep_provider=/usr/lib/galera/libgalera_smm.so
```

```
wsrep_cluster_name="MariaDB Galera Cluster"
```

```
wsrep_cluster_address="gcomm://192.168.30.2,192.168.30.3,192.168.30.4"
```

```
wsrep_node_name="web01"
```

```
wsrep_node_address="192.168.30.2"
```

```
wsrep_sst_method=rsync
```

```
binlog_format=row
```

```
default_storage_engine=InnoDB
```

```
innodb_autoinc_lock_mode=2
```

```
root@web1: ~
GNU nano 6.2 /etc/mysql/mariadb.conf.d/60-galera.cnf
#
# * Galera-related settings
#
# See the examples of server wsrep.cnf files in /usr/share/mysql
# and read more at https://mariadb.com/kb/en/galera-cluster/
[galera]
# Mandatory settings
wsrep_on=ON
wsrep_provider=/usr/lib/galera/libgalera_smm.so
wsrep_cluster_name="MariaDB Galera Cluster"
wsrep_cluster_address="gcomm://192.168.30.2,192.168.30.3,192.168.30.4"
wsrep_node_name="web01"
wsrep_node_address="192.168.30.2"
wsrep_sst_method=rsync
binlog_format=row
default_storage_engine=InnoDB
innodb_autoinc_lock_mode=2
bind-address=0.0.0.0

[ Read 18 lines ]
^G Help      ^O Write Out  ^W Where Is   ^K Cut        ^T Execute    ^C Location   M-U Undo      M-A Set Mark
^X Exit      ^R Read File  ^\ Replace    ^U Paste      ^J Justify    ^/_ Go To Line  M-E Redo      M-G Copy
```

sudo systemctl stop mariadb

galera_new_cluster (Chỉ chạy ở web1)

systemctl start mariadb

-Trên WEB02 và Database Server: Tương tự, chỉ thay đổi wsrep_node_address và wsrep_node_name.

```
root@web2: ~
GNU nano 6.2 /etc/mysql/mariadb.conf.d/60-galera.cnf *
#
# * Galera-related settings
#
# See the examples of server wsrep.cnf files in /usr/share/mysql
# and read more at https://mariadb.com/kb/en/galera-cluster/
[galera]
# Mandatory settings
wsrep_on=ON
wsrep_provider=/usr/lib/galera/libgalera_smm.so
wsrep_cluster_name="MariaDB Galera Cluster"
wsrep_cluster_address="gcomm://192.168.30.2,192.168.30.3,192.168.30.4"
wsrep_node_name="web02"
wsrep_node_address="192.168.30.3"
wsrep_sst_method=rsync
binlog_format=row
default_storage_engine=InnoDB
innodb_autoinc_lock_mode=2
bind-address=0.0.0.0

^G Help      ^O Write Out  ^W Where Is   ^K Cut        ^T Execute    ^C Location   M-U Undo      M-A Set Mark
^X Exit      ^R Read File  ^\ Replace    ^U Paste      ^J Justify    ^/_ Go To Line  M-E Redo      M-G Copy
```

systemctl start mariadb

```
root@db: ~  
GNU nano 6.2 /etc/mysql/mariadb.conf.d/60-galera.cnf *  
#  
# * Galera-related settings  
#  
# See the examples of server wsrep.cnf files in /usr/share/mysql  
# and read more at https://mariadb.com/kb/en/galera-cluster/  
[galera]  
# Mandatory settings  
wsrep_on=ON  
wsrep_provider=/usr/lib/galera/libgalera_smm.so  
wsrep_cluster_name="MariaDB Galera Cluster"  
wsrep_cluster_address="gcomm://192.168.30.2,192.168.30.3,192.168.30.4"  
wsrep_node_name="dbserver"  
wsrep_node_address="192.168.30.4"  
wsrep_sst_method=rsync  
binlog_format=row  
default_storage_engine=InnoDB  
innodb_autoinc_lock_mode=2  
|  
^G Help      ^O Write Out  ^W Where Is   ^K Cut        ^J Execute    ^C Location   M-U Undo      M-A Set Mark  
^X Exit      ^R Read File  ^_ Replace    ^U Paste      ^_ Justify    ^_ Go To Line M-E Redo      M-G Copy
```

systemctl start mariadb

3.3 Kiểm tra cluster

Ở web 1: chạy mysql -u root -p -e "SHOW STATUS LIKE 'wsrep_cluster_size';"

```
root@web1:~# mysql -u root -p -e "SHOW STATUS LIKE 'wsrep_cluster_size';"  
Enter password:  
+-----+-----+  
| Variable_name | Value |  
+-----+-----+  
| wsrep_cluster_size | 3 |  
+-----+-----+  
root@web1:~# |
```

3.4 Cấu hình HAProxy cho database

- Trên Load Balancer, chỉnh sửa haproxy.cfg:

```
sudo nano /etc/haproxy/haproxy.cfg
```

```
frontend mysql_front
```

```
bind *:3306
```

```
mode tcp
```

```
default_backend mysql_back
```

```
backend mysql_back
```

```
mode tcp
```

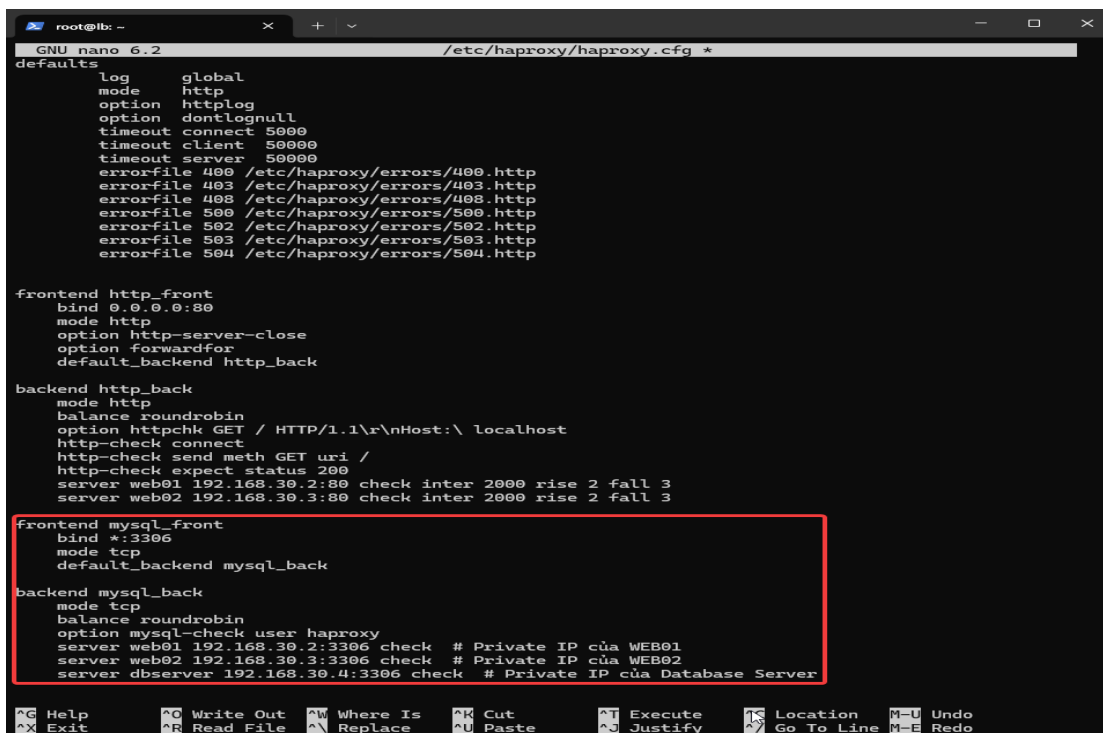
```
balance roundrobin
```

```
option mysql-check user haproxy
```

```
server web01 192.168.30.2:3306 check # Private IP của WEB01
```

```
server web02 192.168.30.3:3306 check # Private IP của WEB02
```

```
server dbserver 192.168.30.4:3306 check # Private IP của Database Server
```



```
GNU nano 6.2 /etc/haproxy/haproxy.cfg *
defaults
    log global
    mode http
    option httplog
    option dontlognull
    timeout connect 5000
    timeout client 50000
    timeout server 50000
    errorfile 400 /etc/haproxy/errors/400.http
    errorfile 403 /etc/haproxy/errors/403.http
    errorfile 408 /etc/haproxy/errors/408.http
    errorfile 500 /etc/haproxy/errors/500.http
    errorfile 502 /etc/haproxy/errors/502.http
    errorfile 503 /etc/haproxy/errors/503.http
    errorfile 504 /etc/haproxy/errors/504.http

frontend http_front
    bind 0.0.0.0:80
    mode http
    option http-server-close
    option forwardfor
    default_backend http_back

backend http_back
    mode http
    balance roundrobin
    option httpchk GET / HTTP/1.1\r\nHost:\ localhost
    http-check connect
    http-check send meth GET uri /
    http-check expect status 200
    server web01 192.168.30.2:80 check inter 2000 rise 2 fall 3
    server web02 192.168.30.3:80 check inter 2000 rise 2 fall 3

frontend mysql_front
    bind *:3306
    mode tcp
    default_backend mysql_back

backend mysql_back
    mode tcp
    balance roundrobin
    option mysql-check user haproxy
    server web01 192.168.30.2:3306 check # Private IP của WEB01
    server web02 192.168.30.3:3306 check # Private IP của WEB02
    server dbserver 192.168.30.4:3306 check # Private IP của Database Server
```

Khởi động lại:

```
sudo systemctl restart haproxy
```

Phần 4. Tạo database và cài WordPress (Câu 4)

Tạo database và cài đặt 1 website WordPress đơn giản với database vừa tạo. Phân quyền cho database chỉ cho phép 5 địa chỉ IP sau truy cập:

- localhost
- 125.212.250.9
- 113.161.61.219
- WEB01
- WEB02

4.1 Tạo database

- Truy cập MySQL trên WEB01:

```
mysql -u root -p
```

- Tạo database và user:

```
CREATE DATABASE wordpress;
```

```
CREATE USER 'wp_user'@'localhost' IDENTIFIED BY 'password';
```

```
CREATE USER 'wp_user'@'125.212.250.9' IDENTIFIED BY 'password';
```

```
CREATE USER 'wp_user'@'113.161.61.219' IDENTIFIED BY 'password';
```

```
CREATE USER 'wp_user'@'192.168.30.2' IDENTIFIED BY 'password'; # Private IP của WEB01
```

```
CREATE USER 'wp_user'@'192.168.30.3' IDENTIFIED BY 'password'; # Private IP của WEB02
```

```
GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'localhost';
```

```
GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'125.212.250.9';
```

```
GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'113.161.61.219';
```

```
GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'192.168.30.2';
```

```
GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'192.168.30.3';
```

```
FLUSH PRIVILEGES;
```

```
EXIT;
```

```

MariaDB [(none)]> CREATE DATABASE wordpress;
ER 'wp_user'@'125.212.250.9' IDENTIFIED BY 'password';
CREATE USER 'wp_user'@'113.161.61.219' IDENTIFIED BY 'password';
CREATE USER 'wp_user'@'192.168.30.2' IDENTIFIED BY 'password'; # Private IP của WEB01
CREATE USER 'wp_user'@'192.168.30.3' IDENTIFIED BY 'password'; # Private IP của WEB02
GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'localhost';
GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'125.212.250.9';
GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'113.161.61.219';
GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'192.168.30.2';
GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'192.168.30.3';
FLUSH PRIVILEGES;
EXIT;Query OK, 1 row affected (0.075 sec)

MariaDB [(none)]> CREATE USER 'wp_user'@'localhost' IDENTIFIED BY 'password';
Query OK, 0 rows affected (0.096 sec)

MariaDB [(none)]> CREATE USER 'wp_user'@'125.212.250.9' IDENTIFIED BY 'password';
Query OK, 0 rows affected (0.103 sec)

MariaDB [(none)]> CREATE USER 'wp_user'@'113.161.61.219' IDENTIFIED BY 'password';
Query OK, 0 rows affected (0.083 sec)

MariaDB [(none)]> CREATE USER 'wp_user'@'192.168.30.2' IDENTIFIED BY 'password'; # Private IP của WEB01
Query OK, 0 rows affected (0.042 sec)

MariaDB [(none)]> CREATE USER 'wp_user'@'192.168.30.3' IDENTIFIED BY 'password'; # Private IP của WEB02
Query OK, 0 rows affected (0.062 sec)

MariaDB [(none)]> GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'localhost';
Query OK, 0 rows affected (0.055 sec)

MariaDB [(none)]> GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'125.212.250.9';
Query OK, 0 rows affected (0.084 sec)

MariaDB [(none)]> GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'113.161.61.219';
Query OK, 0 rows affected (0.091 sec)

MariaDB [(none)]> GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'192.168.30.2';
Query OK, 0 rows affected (0.061 sec)

MariaDB [(none)]> GRANT ALL PRIVILEGES ON wordpress.* TO 'wp_user'@'192.168.30.3';
Query OK, 0 rows affected (0.071 sec)

MariaDB [(none)]> FLUSH PRIVILEGES;
Query OK, 0 rows affected (0.047 sec)

MariaDB [(none)]> EXIT;

```

4.2 Cài đặt WordPress

- Tải và cài đặt trên WEB01:

```
cd /var/www/html
```

```
sudo wget https://wordpress.org/latest.tar.gz
```

```
sudo tar -xvzf latest.tar.gz
```

```
sudo mv wordpress/* .
```

```
sudo rm -rf wordpress latest.tar.gz
```

```
sudo chown -R www-data:www-data /var/www/html
```

```
sudo chmod -R 755 /var/www/html
```

- Cấu hình wp-config.php:

```
sudo cp wp-config-sample.php wp-config.php
```

```
sudo nano wp-config.php
```

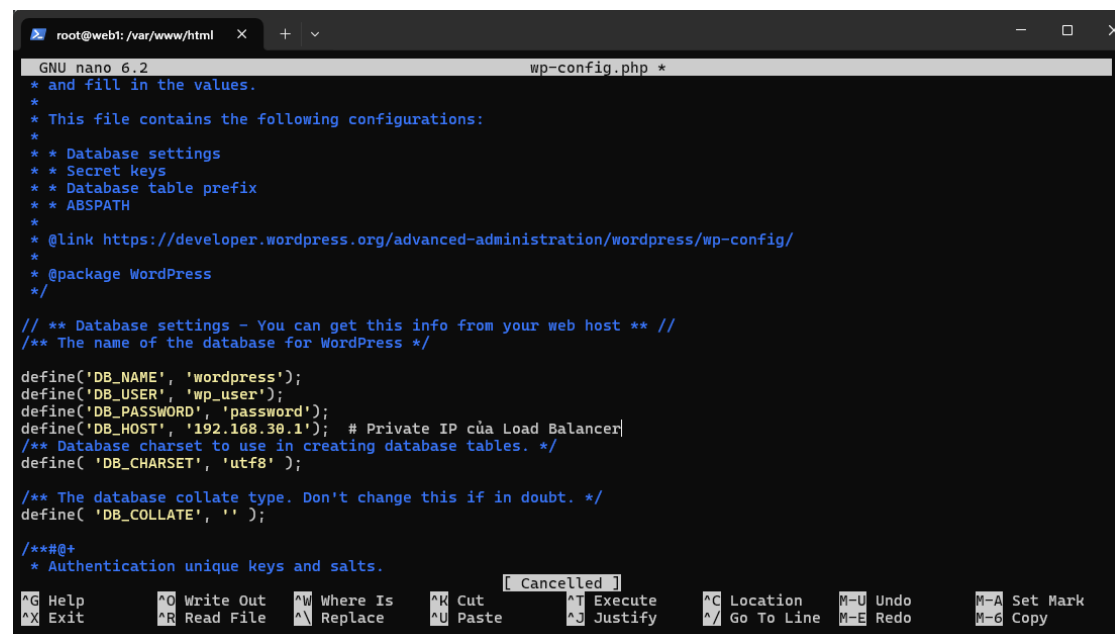
Sửa =>

```
define('DB_NAME', 'wordpress');
```

```
define('DB_USER', 'wp_user');
```

```
define('DB_PASSWORD', 'password');
```

```
define('DB_HOST', '192.168.30.1'); # Private IP của Load Balancer
```



```
root@web01: /var/www/html x + v
GNU nano 6.2 wp-config.php *
* and fill in the values.
*
* This file contains the following configurations:
*
* * Database settings
* * Secret keys
* * Database table prefix
* * ABSPATH
*
* @link https://developer.wordpress.org/advanced-administration/wordpress/wp-config/
*
* @package WordPress
*/

/**
 * Database settings - You can get this info from your web host ** //
 ** The name of the database for WordPress */

define('DB_NAME', 'wordpress');
define('DB_USER', 'wp_user');
define('DB_PASSWORD', 'password');
define('DB_HOST', '192.168.30.1'); # Private IP của Load Balancer
/** Database charset to use in creating database tables. */
define('DB_CHARSET', 'utf8' );

/** The database collate type. Don't change this if in doubt. */
define('DB_COLLATE', '');

/**#@+
 * Authentication unique keys and salts.
 */
^G Help      ^O Write Out  ^W Where Is   ^K Cut        ^T Execute    ^C Location   M-U Undo      M-A Set Mark
^X Exit      ^R Read File  ^\ Replace    ^U Paste      ^J Justify    ^/_ Go To Line M-E Redo      M-G Copy
```

- Kiểm tra truy cập:

```
root@web1:/var/www/html# curl http://192.168.30.2/wp-admin/admin.php
<?php
/**
 * WordPress Administration Bootstrap
 *
 * @package WordPress
 * @subpackage Administration
 */

/**
 * In WordPress Administration Screens
 *
 * @since 2.3.2
 */
if ( ! defined( 'WP_ADMIN' ) ) {
    define( 'WP_ADMIN', true );
}

if ( ! defined( 'WP_NETWORK_ADMIN' ) ) {
    define( 'WP_NETWORK_ADMIN', false );
}

if ( ! defined( 'WP_USER_ADMIN' ) ) {
    define( 'WP_USER_ADMIN', false );
}

if ( ! WP_NETWORK_ADMIN && ! WP_USER_ADMIN ) {
    define( 'WP_BLOG_ADMIN', true );
}

if ( isset( $_GET['import'] ) && ! defined( 'WP_LOAD_IMPORTERS' ) ) {
    define( 'WP_LOAD_IMPORTERS', true );
}
```