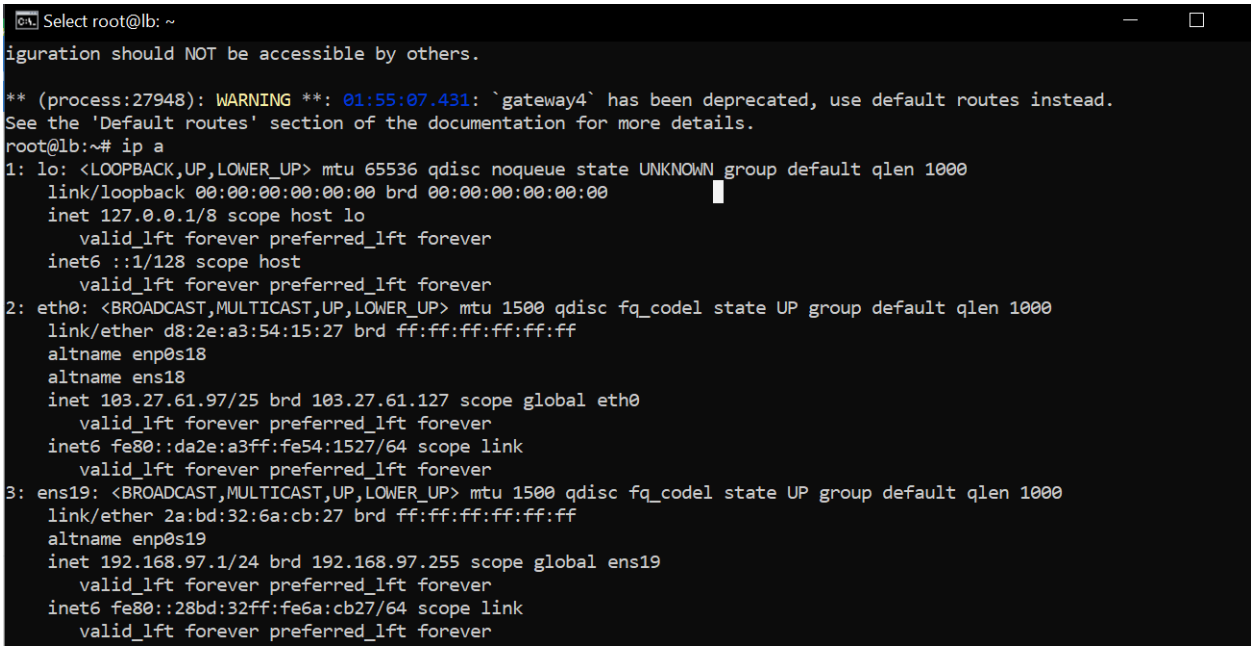
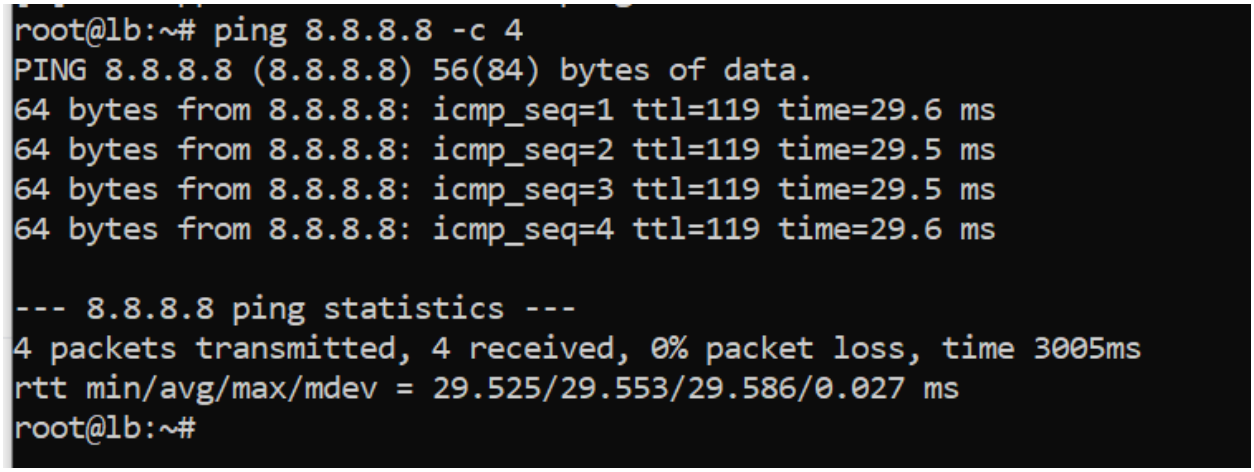
Triển khai hệ thống Load Balancing (haproxy) cho hệ thống webserver và database server

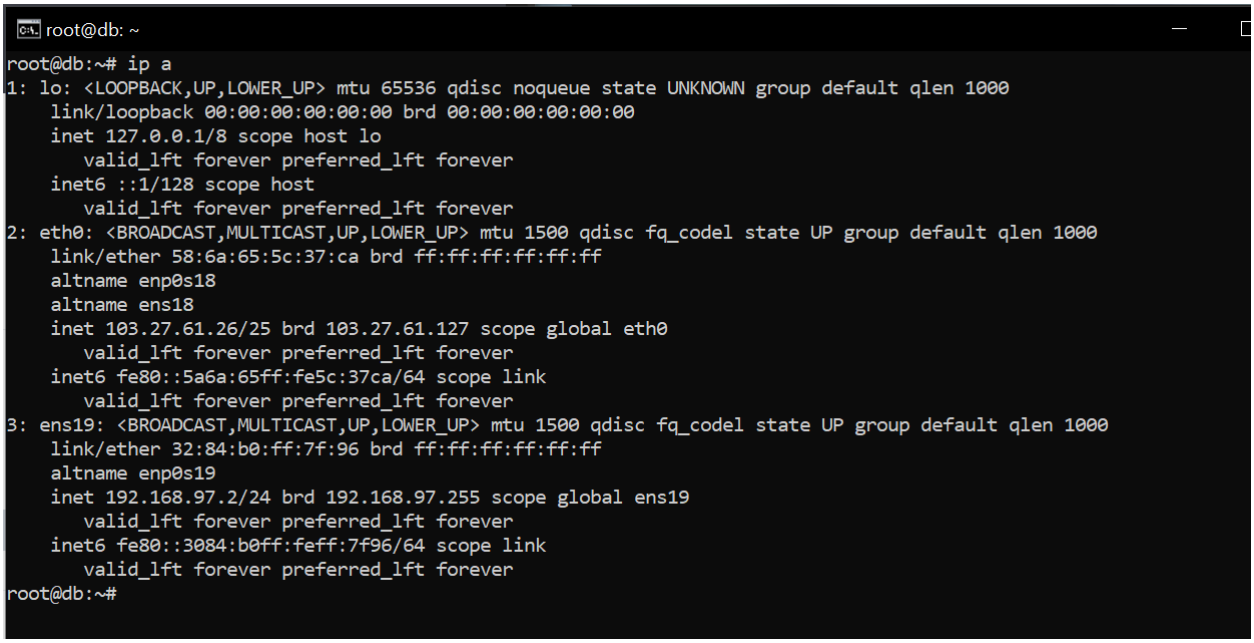
Địa chỉ IP của máy lb:



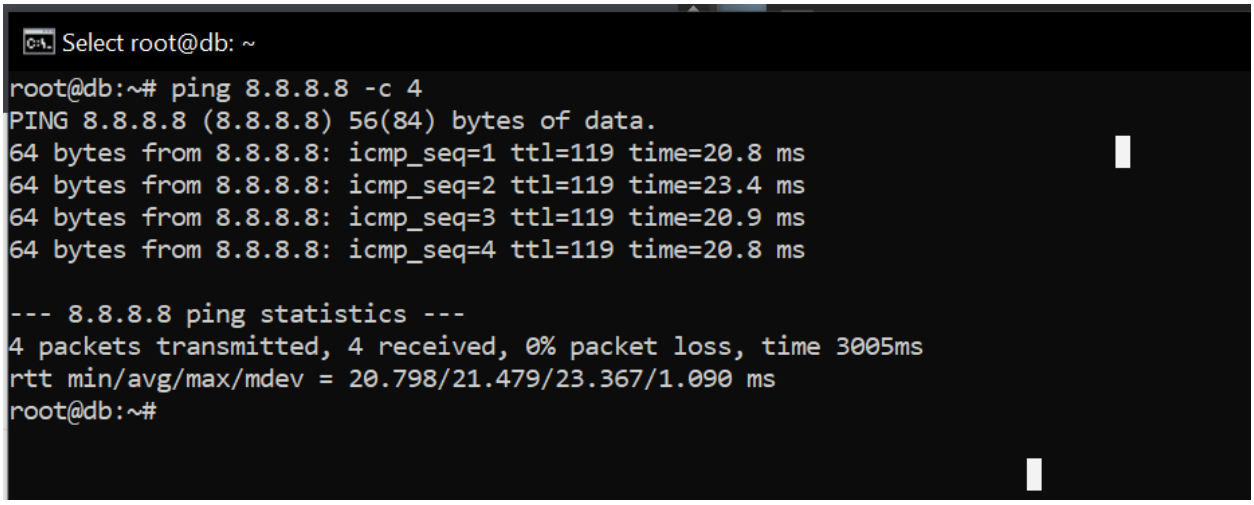
Ping Internet thành công



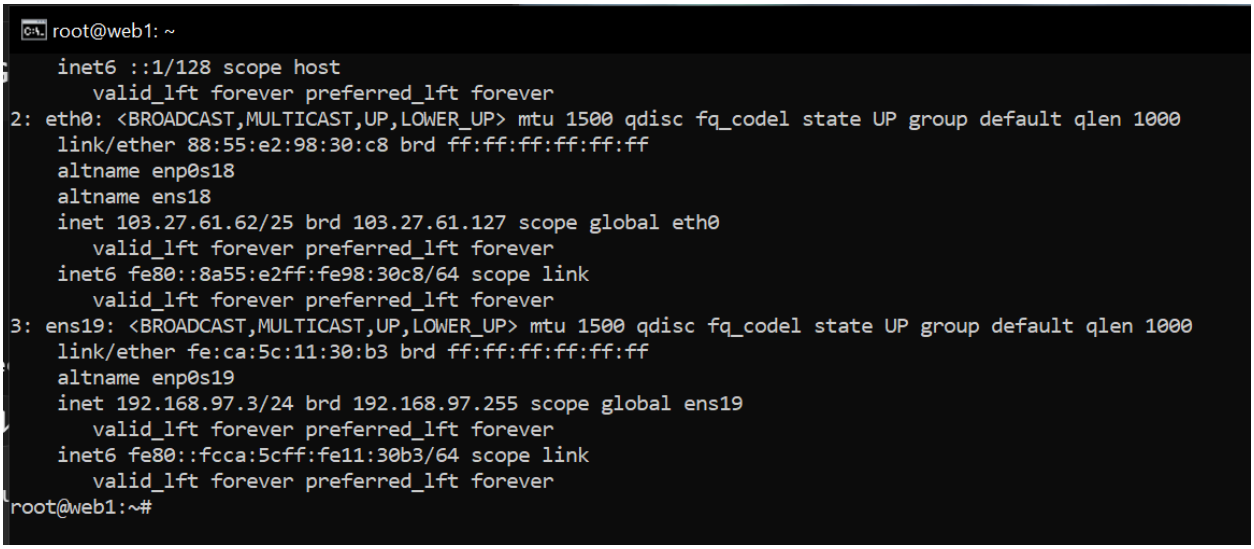
Địa chỉ IP của máy db:



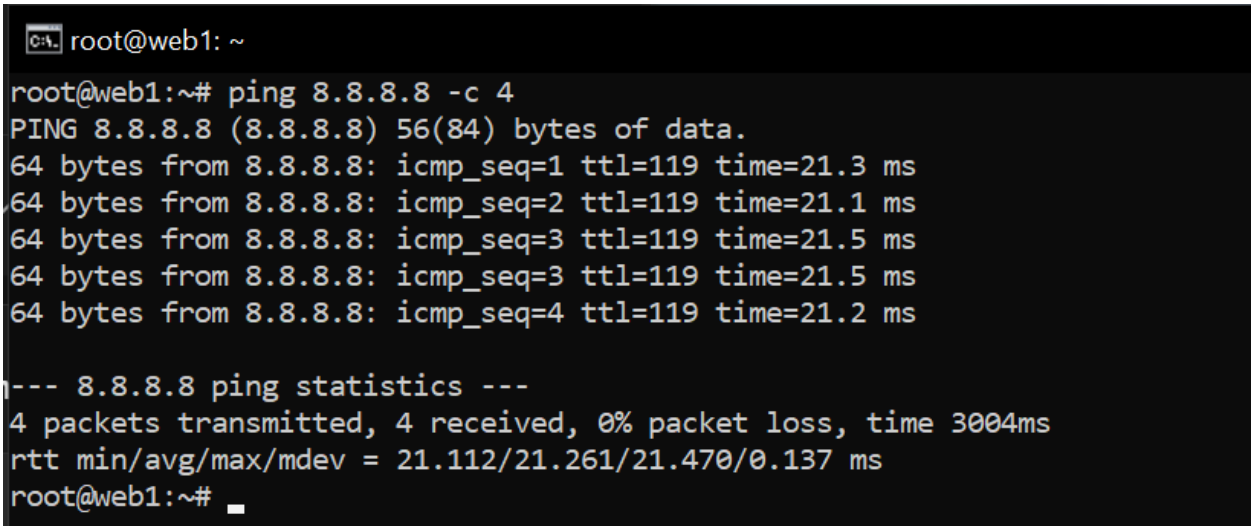
Ping ra Internet



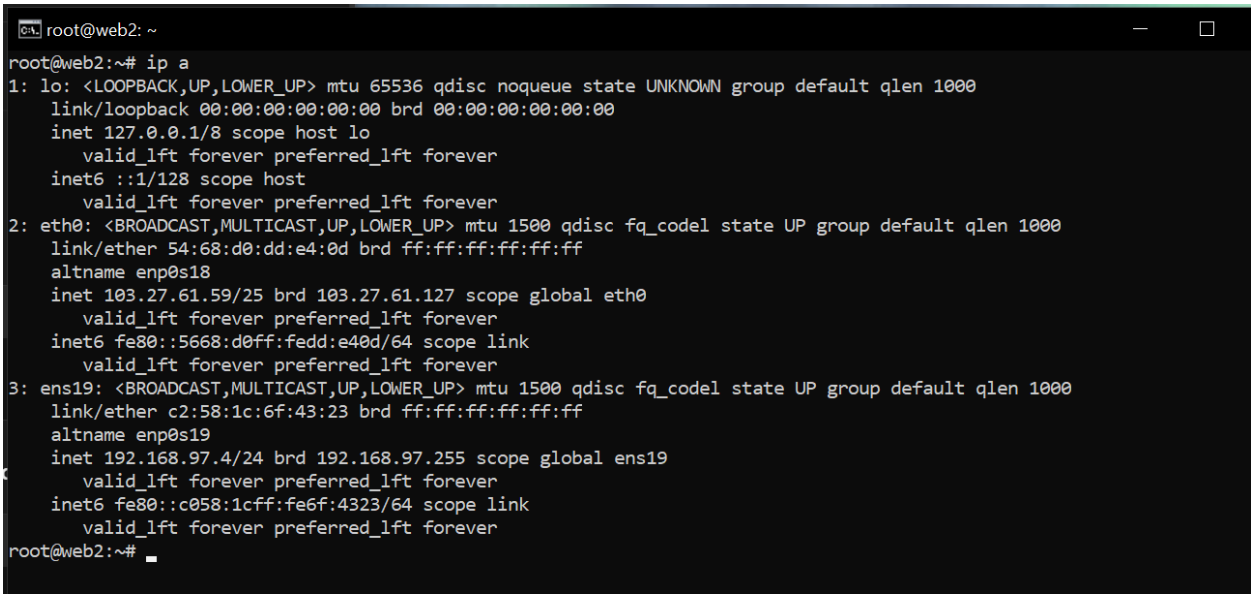
Địa chỉ IP của máy web1



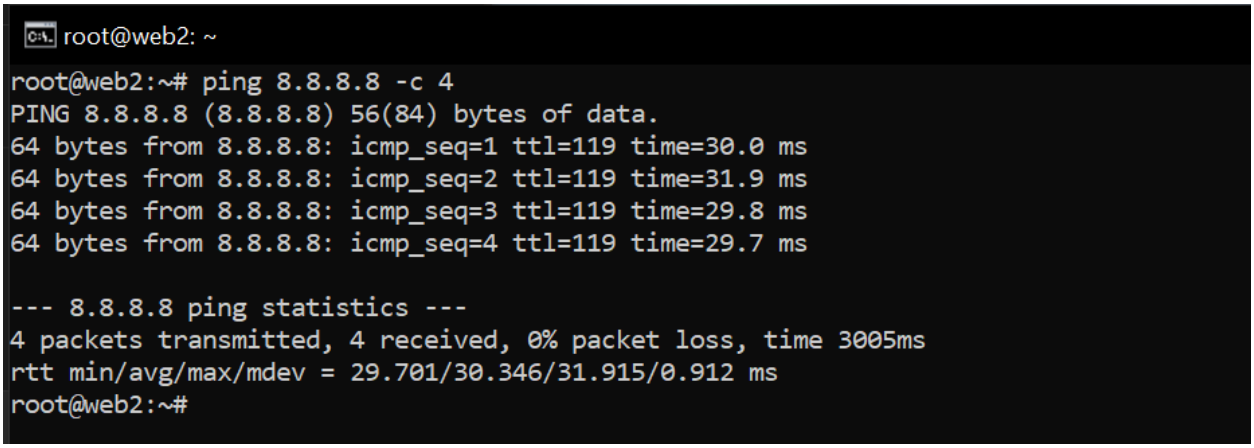
Ping ra Internet



Địa chỉ IP của máy web2:



Ping ra Internet:



Câu 1: Triển khai hệ thống webserver Nginx trên Web01 và Web02, đồng bộ source code bằng lsyncd. (3 điểm)

- Cài đặt Nginx và thư mục web:

Trên Web01 và Web02:

sudo apt update

sudo apt install nginx lsyncd -y

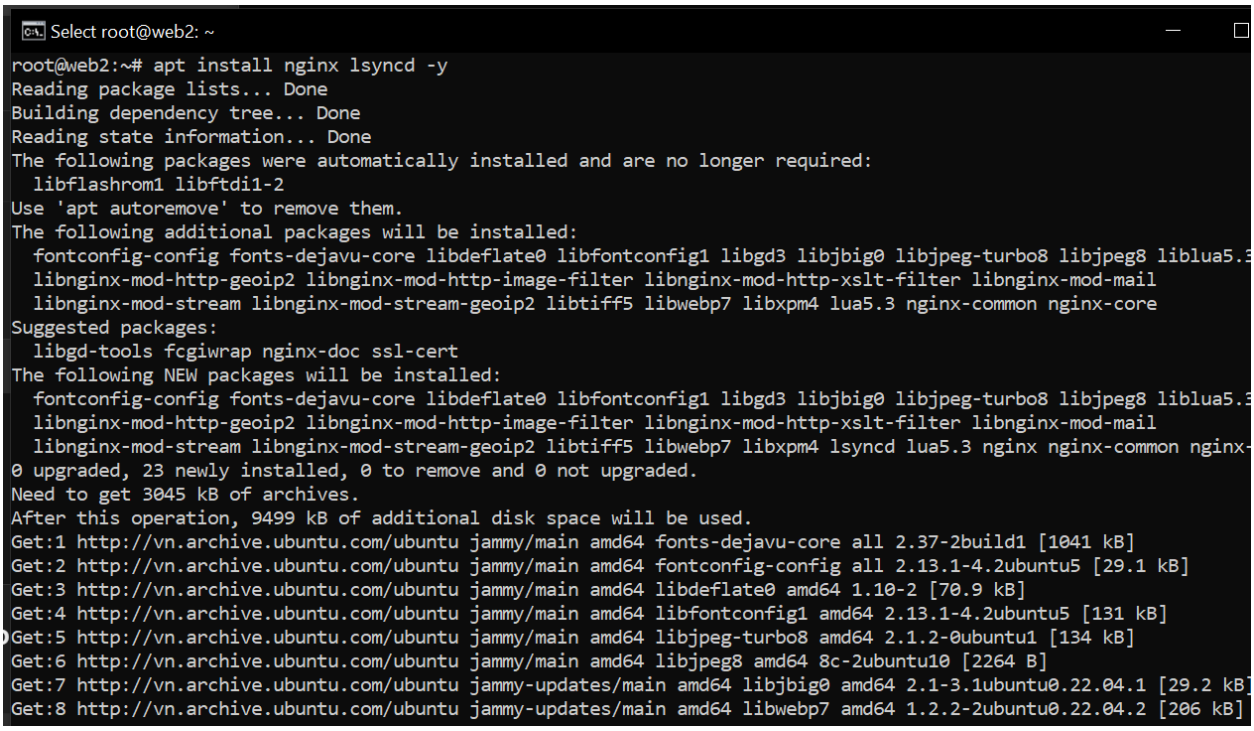
sudo mkdir -p /var/www/html

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

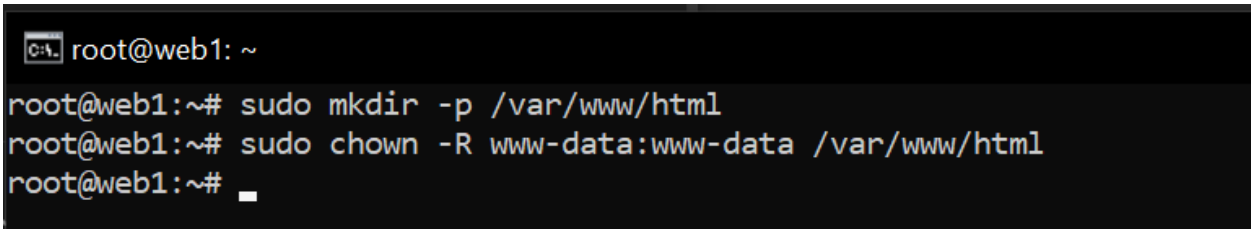
```
root@web1:~# sudo apt update
Hit:1 http://vn.archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://vn.archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:3 http://vn.archive.ubuntu.com/ubuntu jammy-backports InRelease
Get:4 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]
Fetched 129 kB in 7s (17.3 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
All packages are up to date.
```

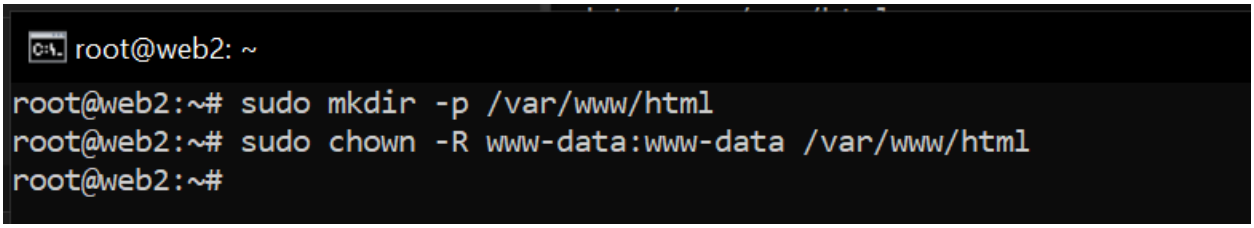
```
root@web1: ~
root@web1:~# apt install nginx lsyncd -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libflashrom1 libftdi1-2
Use 'apt autoremove' to remove them.
The following additional packages will be installed:
  fontconfig-config fonts-dejavu-core libdeflate0 libfontconfig1 libgd3 libjbig0 libjpeg-turbo8 libjpeg8 liblua5.3-0
  libnginx-mod-http-geoip2 libnginx-mod-http-image-filter libnginx-mod-http-xslt-filter libnginx-mod-mail
  libnginx-mod-stream libnginx-mod-stream-geoip2 libtiff5 libwebp7 libxpm4 lua5.3 nginx-common nginx-core
Suggested packages:
  libgd-tools fcgiwrap nginx-doc ssl-cert
The following NEW packages will be installed:
  fontconfig-config fonts-dejavu-core libdeflate0 libfontconfig1 libgd3 libjbig0 libjpeg-turbo8 libjpeg8 liblua5.3-0
  libnginx-mod-http-geoip2 libnginx-mod-http-image-filter libnginx-mod-http-xslt-filter libnginx-mod-mail
  libnginx-mod-stream libnginx-mod-stream-geoip2 libtiff5 libwebp7 libxpm4 lsyncd lua5.3 nginx nginx-common nginx-core
0 upgraded, 23 newly installed, 0 to remove and 0 not upgraded.
Need to get 3045 kB of archives.
After this operation, 9499 kB of additional disk space will be used.
Get:1 http://vn.archive.ubuntu.com/ubuntu jammy/main amd64 fonts-dejavu-core all 2.37-2build1 [1041 kB]
Get:2 http://vn.archive.ubuntu.com/ubuntu jammy/main amd64 fontconfig-config all 2.13.1-4.2ubuntu5 [29.1 kB]
Get:3 http://vn.archive.ubuntu.com/ubuntu jammy/main amd64 libdeflate0 amd64 1.10-2 [70.9 kB]
Get:4 http://vn.archive.ubuntu.com/ubuntu jammy/main amd64 libfontconfig1 amd64 2.13.1-4.2ubuntu5 [131 kB]
Get:5 http://vn.archive.ubuntu.com/ubuntu jammy/main amd64 libjpeg-turbo8 amd64 2.1.2-0ubuntu1 [134 kB]
Get:6 http://vn.archive.ubuntu.com/ubuntu jammy/main amd64 libjpeg8 amd64 8c-2ubuntu10 [2264 B]
Get:7 http://vn.archive.ubuntu.com/ubuntu jammy-updates/main amd64 libjbig0 amd64 2.1-3.1ubuntu0.22.04.1 [29.2 kB]
```

```
root@web2:~# sudo apt update
Hit:1 http://vn.archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://vn.archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:3 http://vn.archive.ubuntu.com/ubuntu jammy-backports InRelease
Get:4 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]
Fetched 129 kB in 7s (17.6 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
All packages are up to date.
root@web2:~#
```



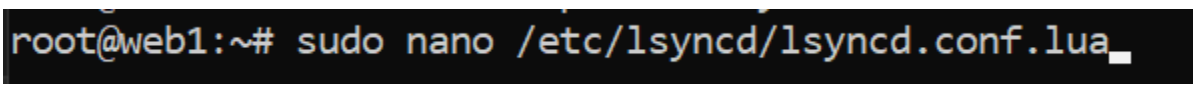
Tạo thư mục source code:

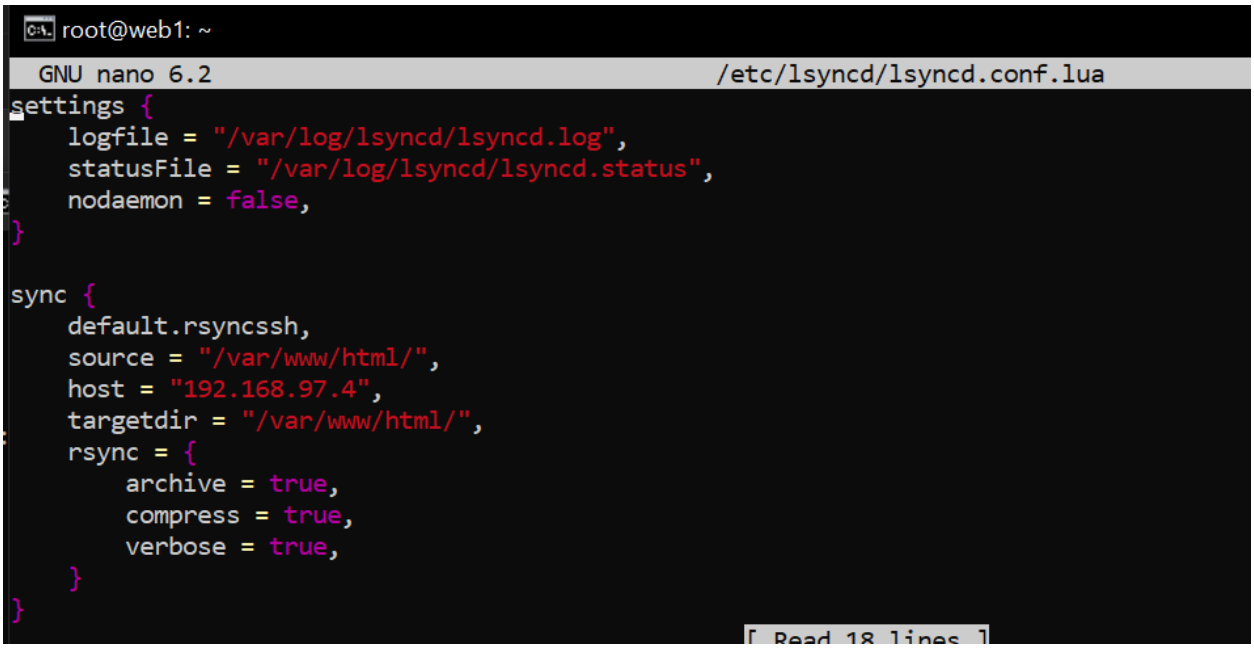




- Trên web1: cấu hình lsyncd để đồng bộ source sang web2:

sudo nano /etc/lsyncd/lsyncd.conf.lua





Giải thích:

Phần cấu hình chung (settings):

- logfile: File ghi lại log quá trình đồng bộ.
- statusFile: Ghi trạng thái hoạt động của Lsyncd.
- nodaemon = false: Cho phép chạy dưới dạng service nền (daemon).

Phần cấu hình sync:

- default.rsyncssh: phương thức đồng bộ dùng rsync qua SSH.
- source: thư mục nguồn trên web1.
- host: địa chỉ IP của web2 (máy nhận dữ liệu).
- targetdir: thư mục đích trên web2.

Phần tùy chọn rsync:

- archive: Bảo toàn quyền, symbolic links, file metadata.
- compress: Nén dữ liệu khi truyền.
- verbose: Ghi log chi tiết quá trình sync.

- Khởi động lsyncd:

sudo systemctl enable 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:~#
```

sudo systemctl start lsyncd

```
root@web1:~# sudo systemctl start lsyncd
```

- Kiểm tra trạng thái **lsyncd** trên web1

```
root@web1:~# sudo systemctl status lsyncd
● lsyncd.service - LSB: lsyncd daemon init script
     Loaded: loaded (/etc/init.d/lsyncd; generated)
     Active: active (exited) since Sat 2025-04-12 02:19:58 UTC; 1h 18min ago
       Docs: man:systemd-sysv-generator(8)
        CPU: 1ms

Apr 12 02:19:58 web1 systemd[1]: Starting LSB: lsyncd daemon init script...
Apr 12 02:19:58 web1 systemd[1]: Started LSB: lsyncd daemon init script.
```

➔ Nếu báo **active** là OK.

- Kiểm tra đồng bộ:

Trên Web01:

echo "<h1>Hello from Web01</h1>" > /var/www/html/index.html

```
root@web1:~# echo "<h1>Hello from Web01</h1>" > /var/www/html/index.html
root@web1:~#
```

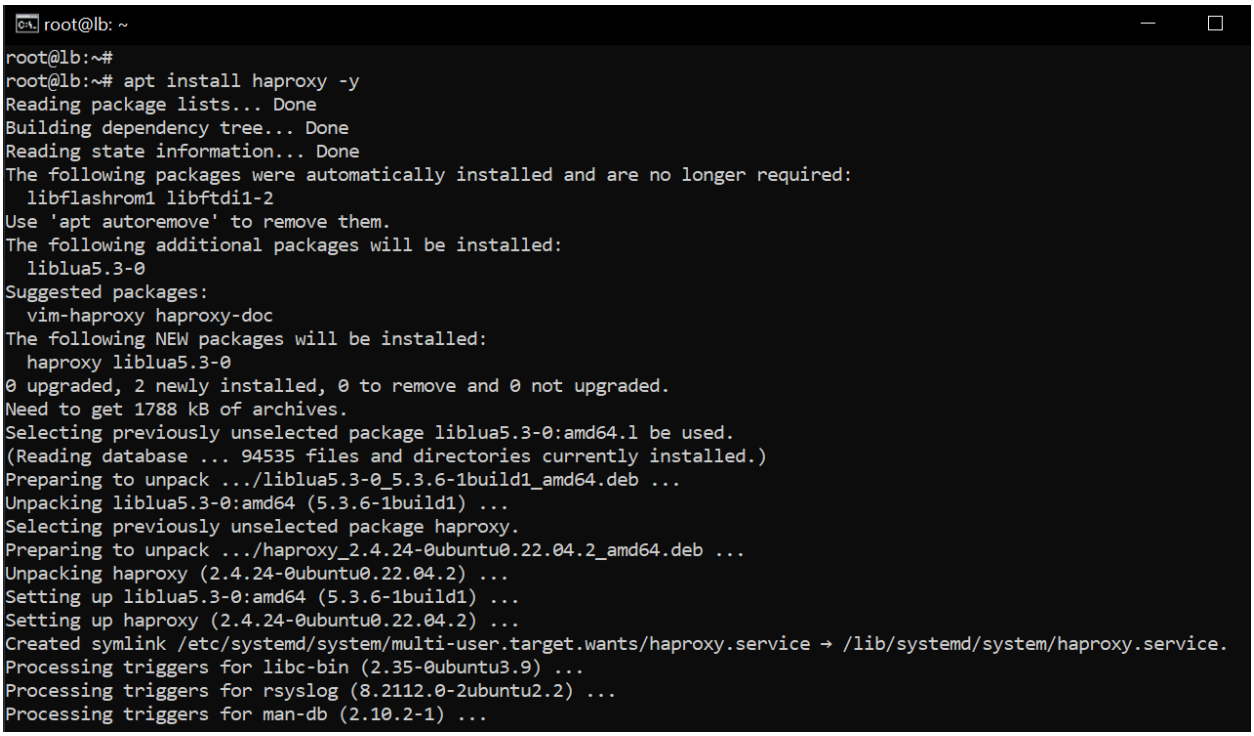
Trên Web02, kiểm tra:

```
root@web2:~# cat /var/www/html/index.html
<h1>Hello from Web01</h1>
```

➔ Kết quả: có nội dung giống như Web01 là OK

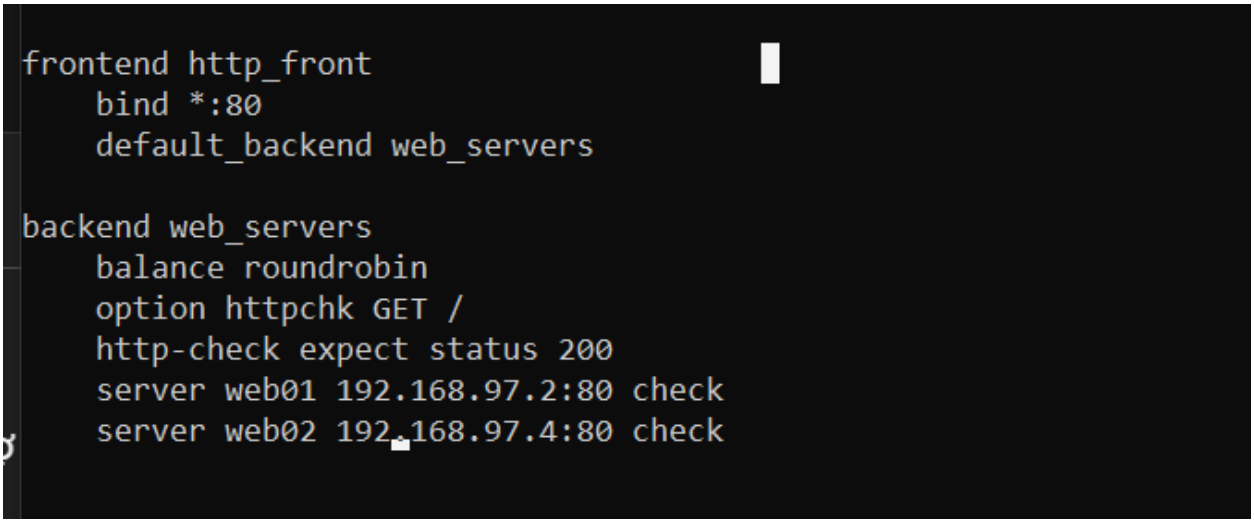
Câu 2: Triển khai HAProxy với Round Robin và Health Check

- **Trên Load Balancer:**



- Cấu hình HAProxy:

  Cấu hình HAProxy tại **/etc/haproxy/haproxy.cfg**:



Giải thích:

- balance roundrobin: chia đều request.
- option httpchk GET /: gửi HTTP GET / để kiểm tra web server còn sống.
- check: bật health check. Nếu web01 hoặc web02 không phản hồi thì HAProxy sẽ tạm thời không gửi request đến server đó.

- Khởi động và kiểm tra HAProxy:

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

- Kiểm tra trạng thái:

```
root@lb:~# ss -tunlp | grep haproxy
tcp   LISTEN 0      4096         0.0.0.0:80        0.0.0.0:*    users:(("haproxy",pid=28953,fd=6))
root@lb:~#
```

Mỗi lần sẽ nhận nội dung từ Web01 hoặc Web02 (nếu bạn set nội dung khác nhau).

- Để kiểm tra Load Balancing hoạt động thế nào:

Bạn có thể thêm nội dung khác nhau vào mỗi server để dễ kiểm tra:

Trên Web01 (103.27.61.62):

echo "Web01 NGINX" > /var/www/html/index.html

```
root@web1:~# echo "<h1>Hello from Web01</h1>" > /var/www/html/index.html
```

Trên Web02 (103.27.61.59):

echo "Web02 NGINX" > /var/www/html/index.html

```
root@web2:~# echo "Hello from Web02" > /var/www/html/index.html
```

- Thực hiện curl đến IP Load Balancer:

```
root@lb:~# curl http://103.27.61.97
<h1>Hello from Web02</h1>
root@lb:~# curl http://103.27.61.97
<h1>Hello from Web01</h1>
```

➔ Kết quả sẽ luân phiên **Web01 / Web02**, chứng minh roundrobin đang hoạt động.

Nếu bạn cần kiểm thử **tình huống Web01 hoặc Web02 bị tắt/ngắt**, HAProxy sẽ tự động loại bỏ server bị lỗi khỏi vòng cân bằng tải, nhờ dòng cấu hình:

```
option httpchk GET /
http-check expect status 200
```

Câu 3: Triển khai cluster database MySQL Galera trên 3 server web01, web02 và Database Server. Sau đó sử dụng load balancer ở câu 2 để cấu hình và điều phối traffic cho bên ngoài kết nối vào database.

Phần 1: Cài đặt Galera Cluster trên 3 server

B1: Cài đặt MariaDB có hỗ trợ Galera

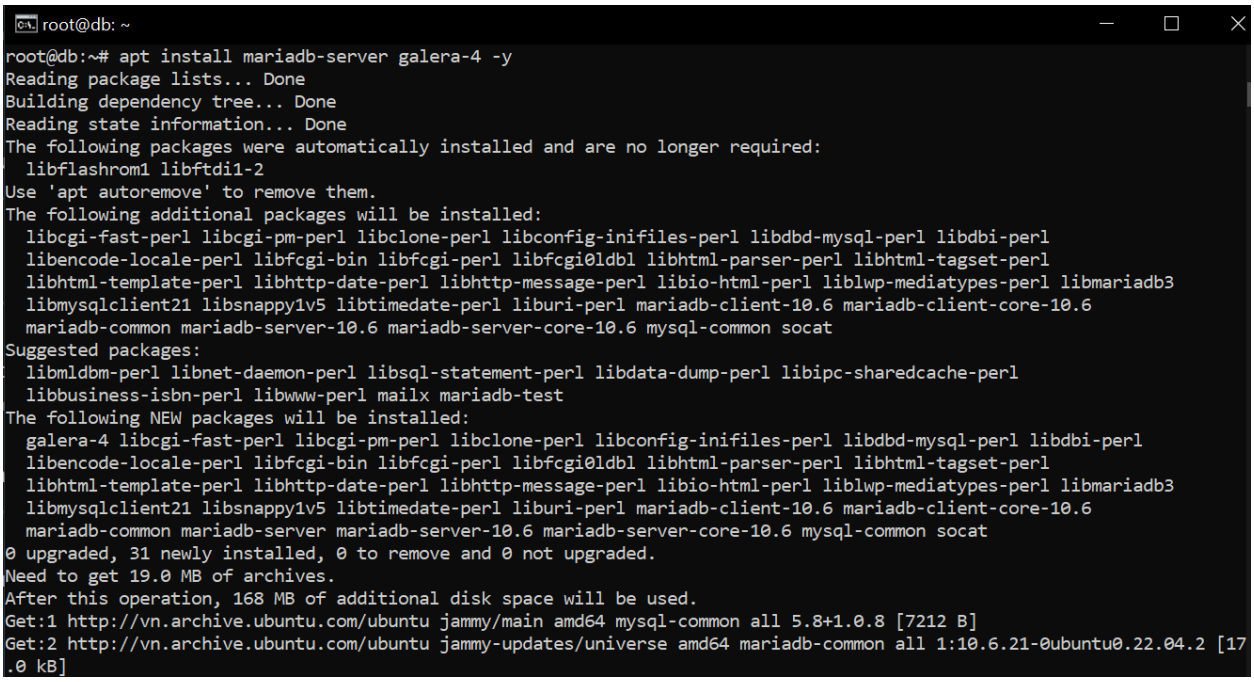
Chạy lệnh này trên cả 3 server (web01, web02, db-server):

Trên db-server:

apt update

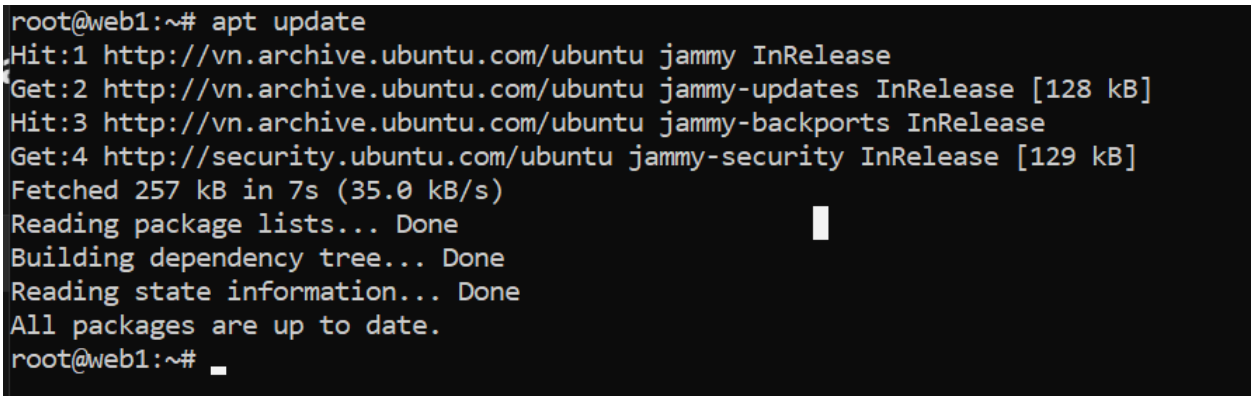
```
root@db:~# apt update
Hit:1 http://vn.archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://vn.archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:3 http://vn.archive.ubuntu.com/ubuntu jammy-backports InRelease
Get:4 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]
Fetched 129 kB in 8s (17.2 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
All packages are up to date.
```

apt install mariadb-server galera-4 -y

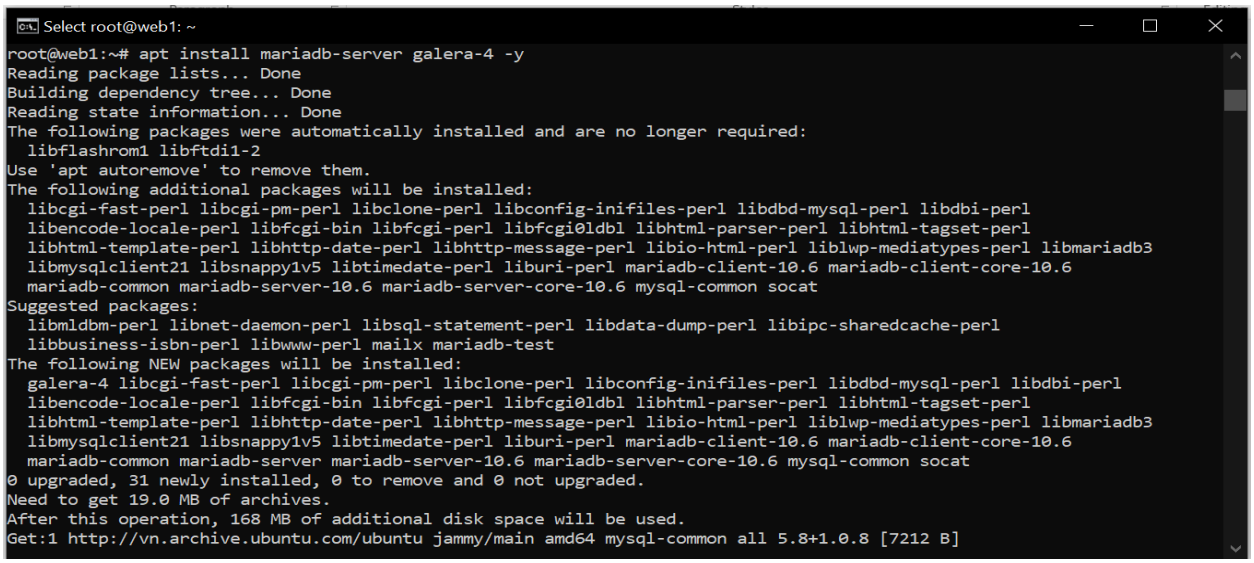


Trên web1:

apt update

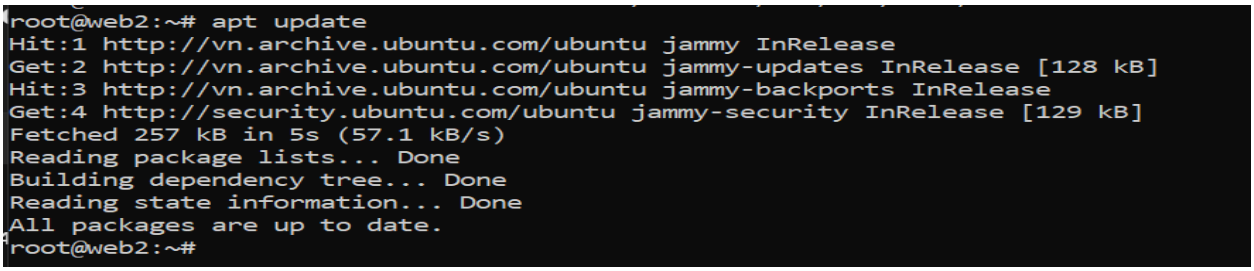


apt install mariadb-server galera-4 –y

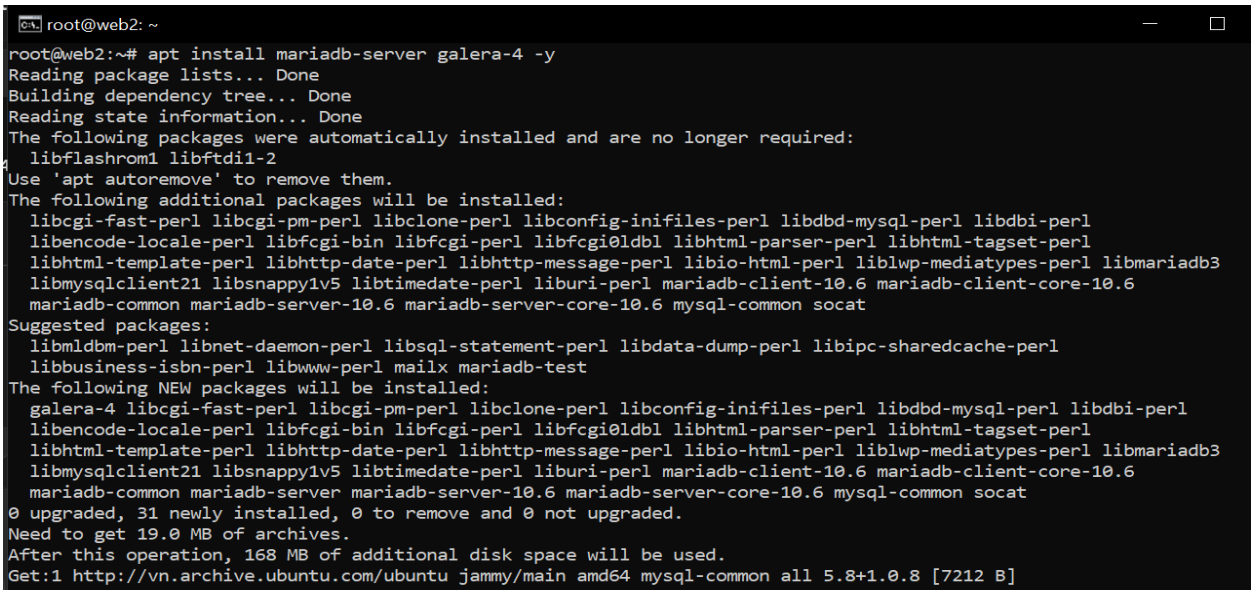


Trên web2:

apt update



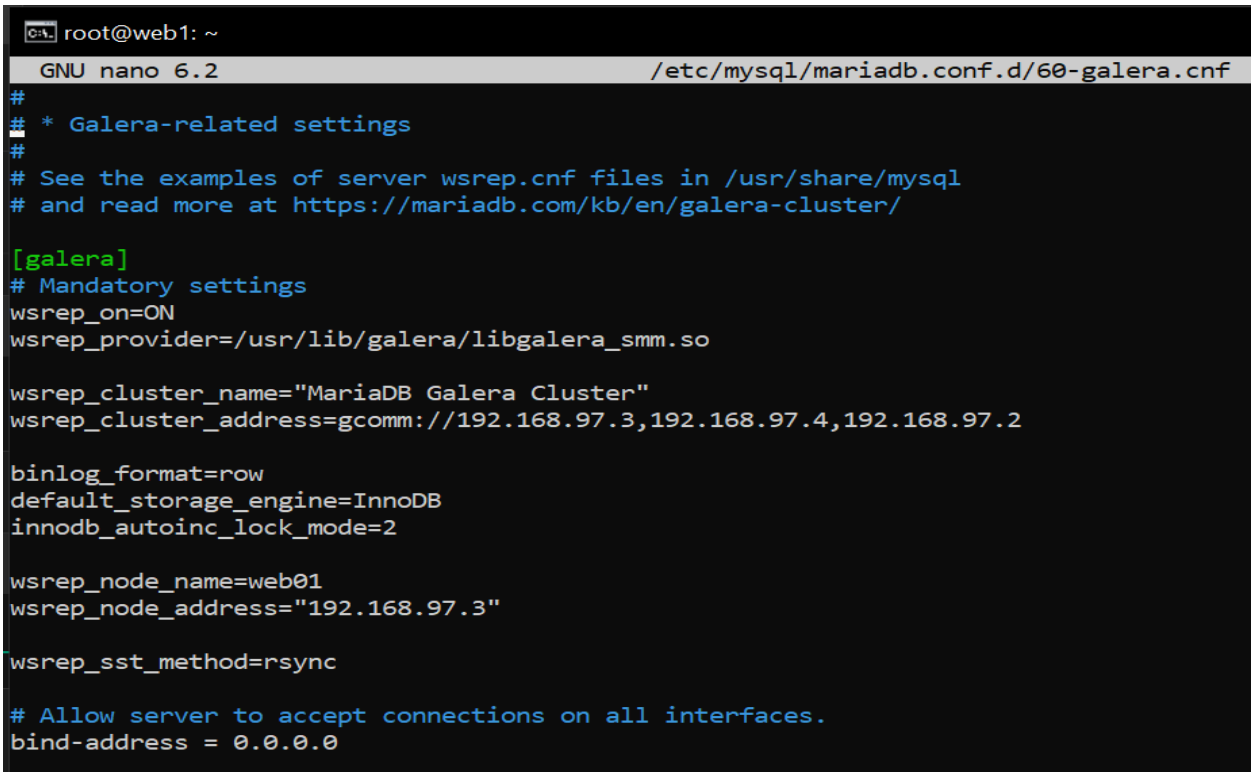
apt install mariadb-server galera-4 -y



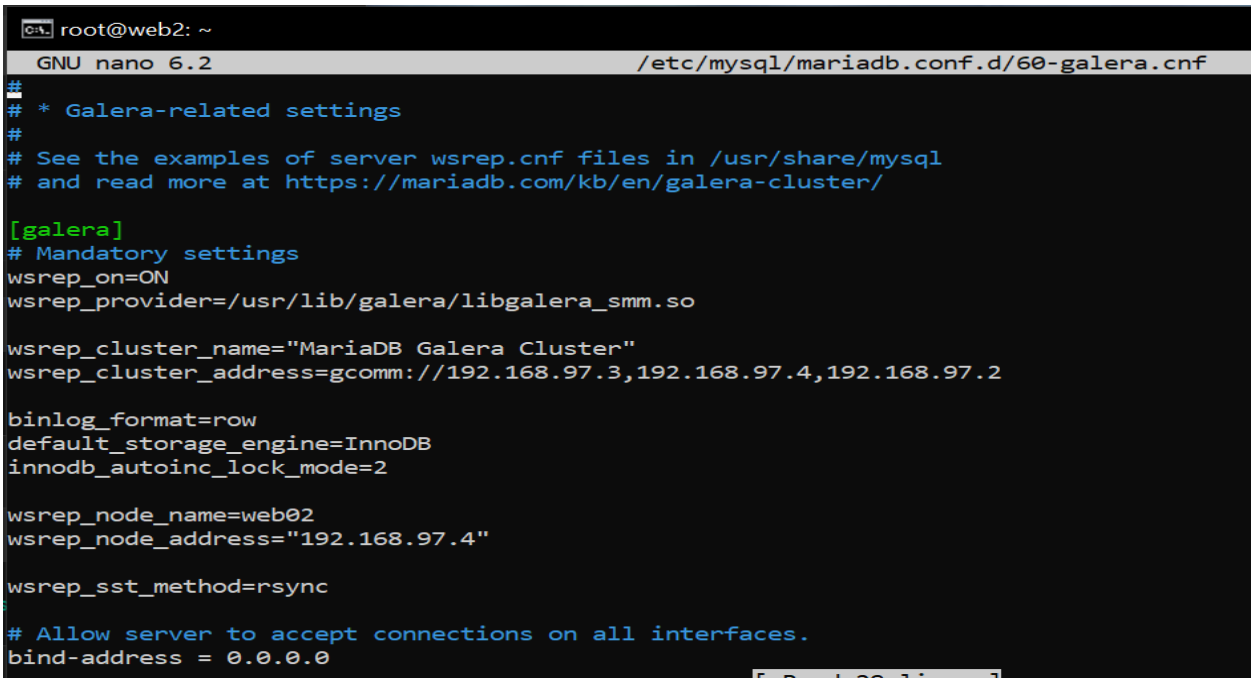
- Chỉnh sửa cấu hình Galera:

Trên mỗi server, mở file:

Trên web1:



Trên web2:



Trên db:

```
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://192.168.97.3,192.168.97.4,192.168.97.2

binlog_format=row
default_storage_engine=InnoDB
innodb_autoinc_lock_mode=2

wsrep_node_name=dbserver
wsrep_node_address="192.168.97.2"

wsrep_sst_method=rsync

# Allow server to accept connections on all interfaces.
bind-address = 0.0.0.0
```

- Sau khi cấu hình xong, khởi động cluster như sau:

Khởi tạo cluster lần đầu trên web01:

```
root@web1:~# galera_new_cluster
```

Trên 2 server còn lại (web02 & db):

```
root@web2:~# systemctl start mariadb
root@web2:~#
```

```
root@db:~# systemctl start mariadb
root@db:~#
```

Kiểm tra trạng thái cluster (trên 1 máy bất kỳ):

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

➔ Kết quả mong đợi: **wsrep_cluster_size = 3**

Điều này chứng tỏ 3 server đã kết nối với nhau thành công trong cùng 1 cluster.

Phần 2: Thêm cấu hình HAProxy cho MySQL Galera (trên Load Balancer)

Mở lại /etc/haproxy/haproxy.cfg, thêm:

```
root@lb: ~
 GNU nano 6.2                                    /etc/haproxy/haproxy.cfg *
        errorfile 502 /etc/haproxy/errors/502.http
        errorfile 503 /etc/haproxy/errors/503.http
        errorfile 504 /etc/haproxy/errors/504.http


# ================= Frontend cho HTTP =================
frontend http_front
    bind *:80
    default_backend web_servers

# ================= Backend cho webserver =================
backend web_servers
    balance roundrobin
    option httpchk GET /
    http-check expect status 200
    server web01 192.168.97.3:80 check
    server web02 192.168.97.4:80 check

# ================= MySQL Cluster =================
listen mysql-cluster
    bind *:3306
    mode tcp
    balance roundrobin
    option mysql-check user haproxy
    server db1 192.168.97.3:3306 check
    server db2 192.168.97.4:3306 check
    server db3 192.168.97.2:3306 check
```

Sau khi chỉnh file xong, hãy:

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

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

1. Localhost

2. 125.212.250.9

3. 113.161.61.219

4. Web01 (192.168.97.3)

5. Web02 (192.168.97.4)

- Tạo database và user cho Wordpress

Mở MySQL trên bất kỳ server nào trong Galera Cluster (dữ liệu sẽ đồng bộ toàn bộ):

```
MariaDB [(none)]> GRANT ALL PRIVILEGES ON wordpress.* TO 'wpuser'@'localhost';
Query OK, 0 rows affected (0.097 sec)
```

```
MariaDB [(none)]> CREATE USER 'wpuser'@'localhost' IDENTIFIED BY 'PasswordWP12!@';
Query OK, 0 rows affected (0.135 sec)
```

```
MariaDB [(none)]> GRANT ALL PRIVILEGES ON wordpress.* TO 'wpuser'@'125.212.250.9';
Query OK, 0 rows affected (0.186 sec)
```

```
MariaDB [(none)]> CREATE USER 'wpuser'@'125.212.250.9' IDENTIFIED BY 'PasswordWP12!@';
Query OK, 0 rows affected (0.133 sec)
```

```
MariaDB [(none)]> CREATE USER 'wpuser'@'113.161.61.219' IDENTIFIED BY 'PasswordWP12!@';
Query OK, 0 rows affected (0.080 sec)
```

```
MariaDB [(none)]> GRANT ALL PRIVILEGES ON wordpress.* TO 'wpuser'@'113.161.61.219';
Query OK, 0 rows affected (0.039 sec)
```

```
MariaDB [(none)]> CREATE USER 'wpuser'@'192.168.97.3' IDENTIFIED BY 'PasswordWP12!@';
Query OK, 0 rows affected (0.081 sec)
```

```
MariaDB [(none)]> GRANT ALL PRIVILEGES ON wordpress.* TO 'wpuser'@'192.168.97.3';
Query OK, 0 rows affected (0.079 sec)
```

```
MariaDB [(none)]> CREATE USER 'wpuser'@'192.168.97.4' IDENTIFIED BY 'PasswordWP12!@';
Query OK, 0 rows affected (0.074 sec)
```

```
MariaDB [(none)]> GRANT ALL PRIVILEGES ON wordpress.* TO 'wpuser'@'192.168.97.4';
Query OK, 0 rows affected (0.171 sec)
```

Sau khi chạy lệnh này, mọi IP khác không nằm trong danh sách trên sẽ không truy cập được DB.

Áp dụng thay đổi:

```
MariaDB [(none)]> FLUSH PRIVILEGES;
Query OK, 0 rows affected (0.097 sec)
```

- Cài đặt WordPress đơn giản trên Web01

  Cài đặt các gói cần thiết:

```
root@web1:~# apt update
Hit:1 http://vn.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://vn.archive.ubuntu.com/ubuntu jammy-updates InRelease [128 kB]
Hit:3 http://vn.archive.ubuntu.com/ubuntu jammy-backports InRelease
Get:4 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]
Fetched 257 kB in 8s (32.6 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
All packages are up to date.
```

```
root@web1:~# apt install php php-mysql php-fpm mariadb-client wget unzip -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
php is already the newest version (2:8.1+92ubuntu1).
php-mysql is already the newest version (2:8.1+92ubuntu1).
php-fpm is already the newest version (2:8.1+92ubuntu1).
unzip is already the newest version (6.0-26ubuntu3.2).
wget is already the newest version (1.21.2-2ubuntu1.1).
mariadb-client is already the newest version (1:10.6.21-0ubuntu0.22.04.2).
The following packages were automatically installed and are no longer required:
  libflashrom1 libftdi1-2
Use 'apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
root@web1:~#
```

- Tải và triển khai WordPress:

```
root@web1:~# cd /var/www/html
root@web1:/var/www/html#
```

```
root@web1:/var/www/html# wget https://wordpress.org/latest.zip
--2025-04-12 07:19:22--  https://wordpress.org/latest.zip
Resolving wordpress.org (wordpress.org)... 198.143.164.252
Connecting to wordpress.org (wordpress.org)|198.143.164.252|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 28410097 (27M) [application/zip]
Saving to: ‘latest.zip’

latest.zip                  100%[=============================================>]  27.0

2025-04-12 07:19:28 (6.10 MB/s) - ‘latest.zip’ saved [28410097/28410097]

root@web1:/var/www/html#
```

```
root@web1:/var/www/html# unzip latest.zip
Archive:  latest.zip
   creating: wordpress/
  inflating: wordpress/xmlrpc.php
  inflating: wordpress/wp-blog-header.php
  inflating: wordpress/readme.html
  inflating: wordpress/wp-signup.php
  inflating: wordpress/index.php
  inflating: wordpress/wp-cron.php
  inflating: wordpress/wp-config-sample.php
  inflating: wordpress/wp-login.php
  inflating: wordpress/wp-settings.php
  inflating: wordpress/license.txt
   creating: wordpress/wp-content/
   creating: wordpress/wp-content/themes/
   creating: wordpress/wp-content/themes/twentytwentythree/
  inflating: wordpress/wp-content/themes/twentytwentythree/theme.json
   creating: wordpress/wp-content/themes/twentytwentythree/parts/
  inflating: wordpress/wp-content/themes/twentytwentythree/parts/footer.html
  inflating: wordpress/wp-content/themes/twentytwentythree/parts/comments.html
  inflating: wordpress/wp-content/themes/twentytwentythree/parts/header.html
  inflating: wordpress/wp-content/themes/twentytwentythree/parts/post-meta.html
   creating: wordpress/wp-content/themes/twentytwentythree/patterns/
  inflating: wordpress/wp-content/themes/twentytwentythree/patterns/hidden-404.php
  inflating: wordpress/wp-content/themes/twentytwentythree/patterns/post-meta.php
  inflating: wordpress/wp-content/themes/twentytwentythree/patterns/hidden-no-results.php
  inflating: wordpress/wp-content/themes/twentytwentythree/patterns/hidden-heading.php
```

```
root@web1:/var/www/html# mv wordpress/* .
root@web1:/var/www/html#
```

```
root@web1:/var/www/html# rm -rf wordpress latest.zip
```

```
root@web1:/var/www/html# chown -R www-data:www-data /var/www/html
```

- Cấu hình kết nối MySQL trong WordPress:

```
root@web1:~# cd /var/www/html
root@web1:/var/www/html#
```

```
root@web1:/var/www/html# cp wp-config-sample.php wp-config.php
root@web1:/var/www/html#
```

```
root@web1:/var/www/html# nano wp-config.php
```

```
root@web1: /var/www/html
 GNU nano 6.2                                  wp-config.php *
 * @package WordPress
 */

// ** Database settings - You can get this info from your web host ** //
/** The name of the database for WordPress */
define( 'DB_NAME', 'wordpress' );

/** Database username */
define( 'DB_USER', 'wpuser' );

/** Database password */
define( 'DB_PASSWORD', 'PasswordWP12!@' );

/** Database hostname */
define( 'DB_HOST', '103.27.61.97:3306' );
```

- Truy cập website