

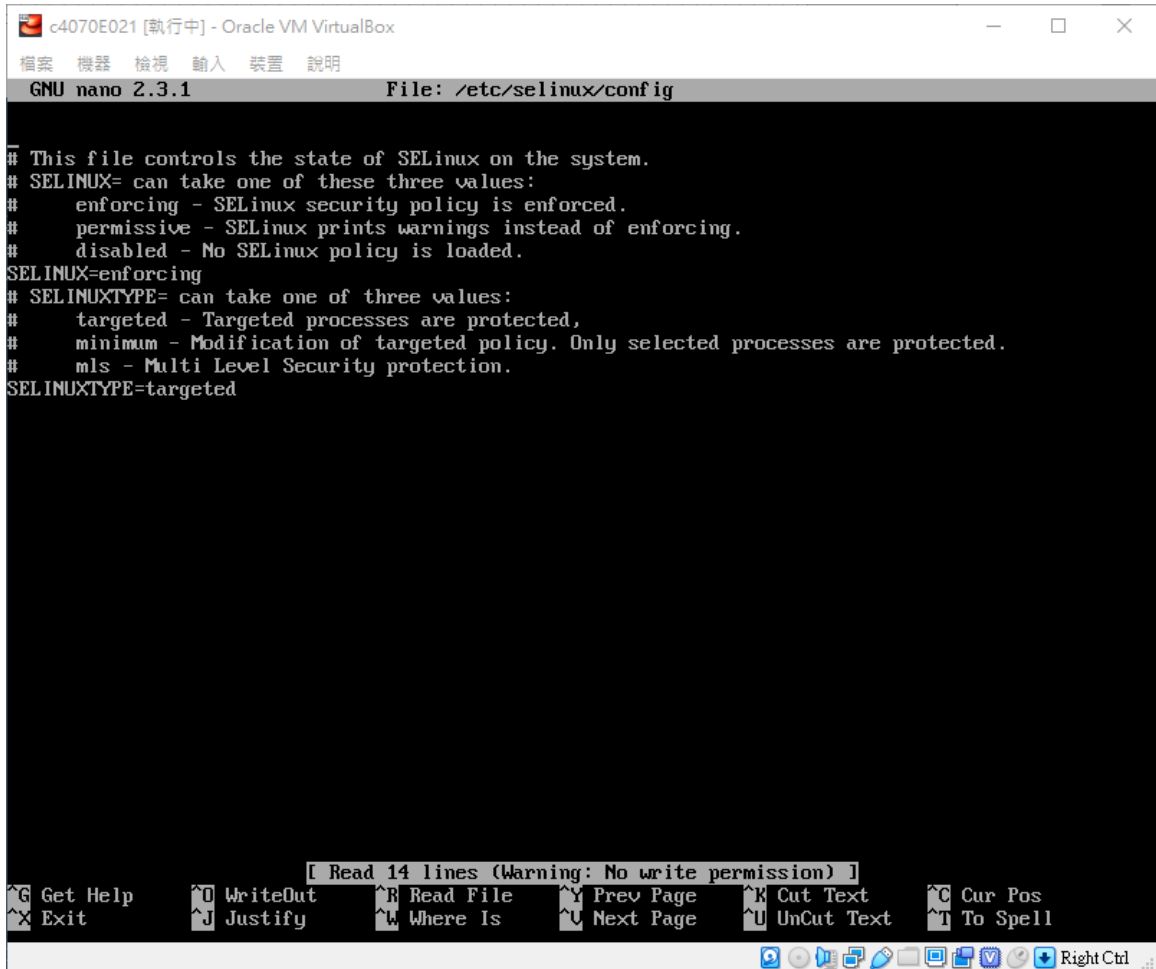
Linux 作業系統實務雙講師課程實作成果

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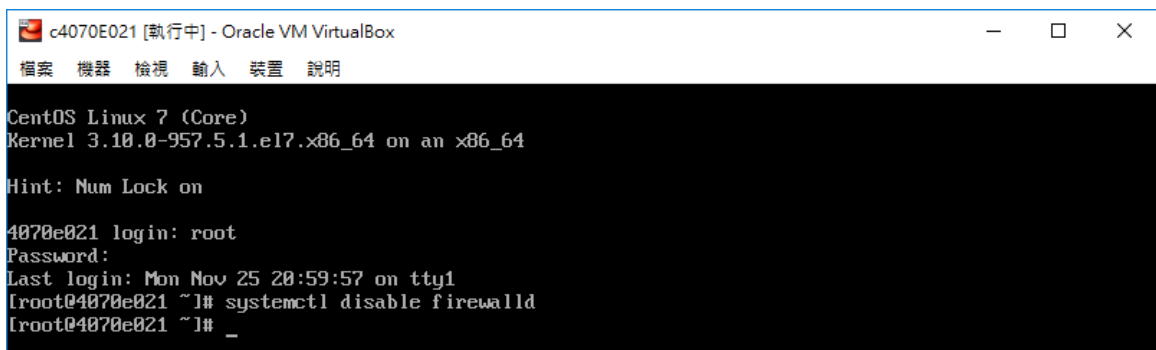
LAMP 實作過程與結果



The screenshot shows a terminal window titled "c4070E021 [執行中] - Oracle VM VirtualBox". Inside, the GNU nano 2.3.1 text editor is open, editing the file /etc/selinux/config. The file content is as follows:

```
# This file controls the state of SELinux on the system.
# SELINUX= can take one of these three values:
#   enforcing - SELinux security policy is enforced.
#   permissive - SELinux prints warnings instead of enforcing.
#   disabled - No SELinux policy is loaded.
SELINUX=enforcing
# SELINUXTYPE= can take one of three values:
#   targeted - Targeted processes are protected,
#   minimum - Modification of targeted policy. Only selected processes are protected.
#   mls - Multi Level Security protection.
SELINUXTYPE=targeted
```

The nano editor's status bar at the bottom shows "Read 14 lines (Warning: No write permission)]". The bottom of the window displays various keyboard shortcuts like ^G Get Help, ^X Exit, ^O WriteOut, etc.



The screenshot shows a terminal window titled "c4070E021 [執行中] - Oracle VM VirtualBox". The terminal output is as follows:

```
CentOS Linux 7 (Core)
Kernel 3.10.0-957.5.1.el7.x86_64 on an x86_64

Hint: Num Lock on

4070e021 login: root
Password:
Last login: Mon Nov 25 20:59:57 on tty1
[root@4070e021 ~]# systemctl disable firewalld
[root@4070e021 ~]# _
```

1. 安裝 httpd 套件

```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明

CentOS Linux 7 (Core)
Kernel 3.10.0-957.5.1.el7.x86_64 on an x86_64

Hint: Num Lock on

4070e021 login: root
Password:
Last login: Mon Nov 25 21:01:19 on tty1
[root@4070e021 ~]# yum -y install httpd
Loaded plugins: fastestmirror
Determining fastest mirrors
 * base: ftp.ksu.edu.tw
 * centos-sclo-rh: ftp.ksu.edu.tw
 * centos-sclo-sclo: ftp.ksu.edu.tw
 * extras: ftp.ksu.edu.tw
 * updates: ftp.ksu.edu.tw
base                                                    | 3.6 kB  00:00:00
centos-sclo-rh                                          | 3.0 kB  00:00:00
centos-sclo-sclo                                        | 2.9 kB  00:00:00
extras                                                  | 2.9 kB  00:00:00
mariadb                                                 | 2.9 kB  00:00:00
updates                                                 | 2.9 kB  00:00:00
(1/4): centos-sclo-sclo/x86_64/primary_db              | 322 kB  00:00:00
(2/4): mariadb/primary_db                             | 57 kB   00:00:01
(3/4): updates/7/x86_64/primary_db                    | 4.2 MB  00:00:01
(4/4): centos-sclo-rh/x86_64/primary_db                | 4.0 MB  00:00:01
Package httpd-2.4.6-90.el7.centos.x86_64 already installed and latest version
Nothing to do
```

2. 安裝 nano 套件

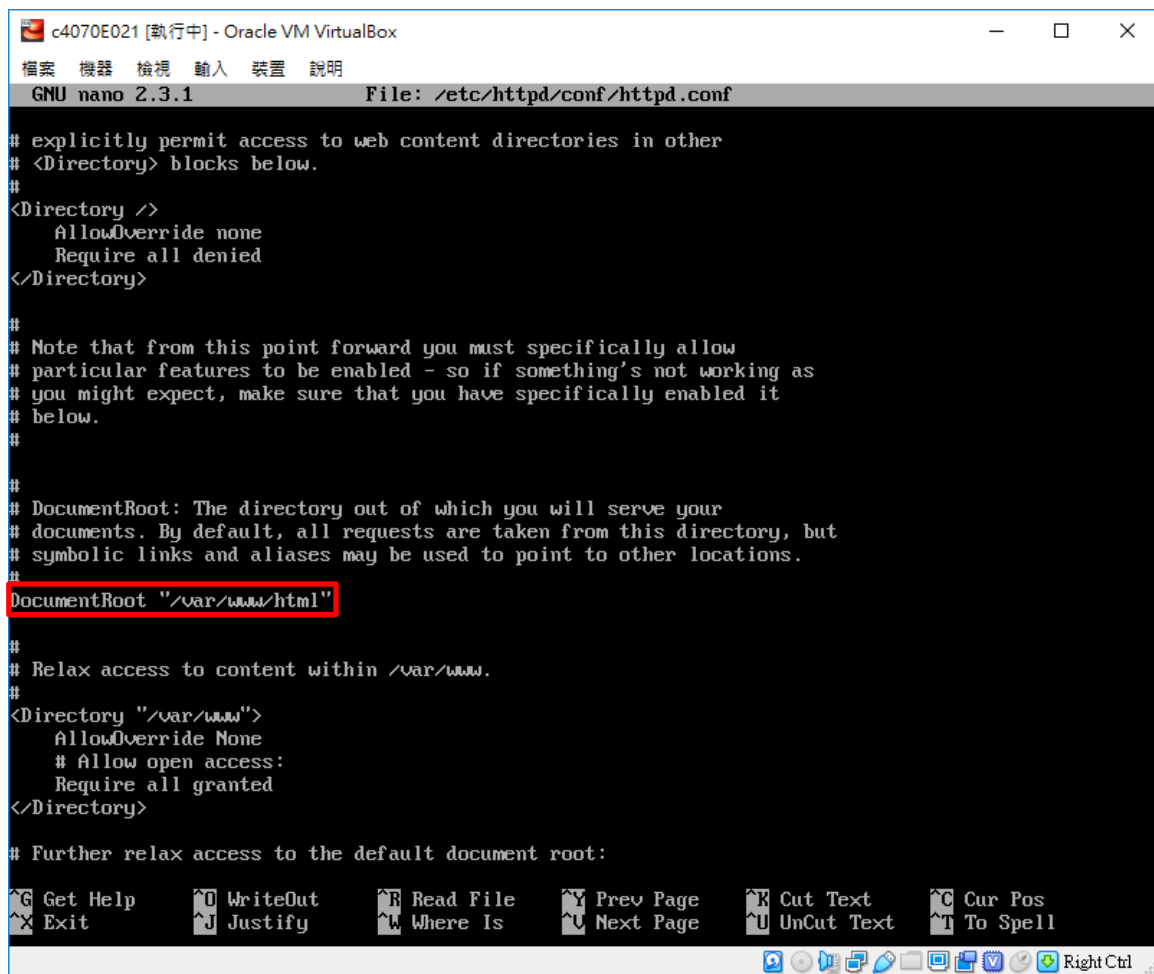
```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明

CentOS Linux 7 (Core)
Kernel 3.10.0-957.5.1.el7.x86_64 on an x86_64

Hint: Num Lock on

4070e021 login: root
Password:
Last login: Mon Nov 25 21:02:41 on tty1
[root@4070e021 ~]# yum -y install nano
Loaded plugins: fastestmirror
Loading mirror speeds from cached hostfile
 * base: ftp.ksu.edu.tw
 * centos-sclo-rh: ftp.ksu.edu.tw
 * centos-sclo-sclo: ftp.ksu.edu.tw
 * extras: ftp.ksu.edu.tw
 * updates: ftp.ksu.edu.tw
Package nano-2.3.1-10.el7.x86_64 already installed and latest version
Nothing to do
```

3. 檢視 web server 根目錄



```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明
GNU nano 2.3.1 File: /etc/httpd/conf/httpd.conf

# explicitly permit access to web content directories in other
# <Directory> blocks below.
#
<Directory />
    AllowOverride none
    Require all denied
</Directory>

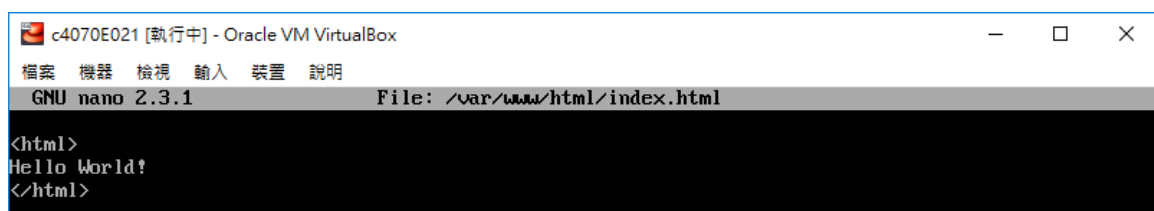
#
# Note that from this point forward you must specifically allow
# particular features to be enabled - so if something's not working as
# you might expect, make sure that you have specifically enabled it
# below.
#
#
# DocumentRoot: The directory out of which you will serve your
# documents. By default, all requests are taken from this directory, but
# symbolic links and aliases may be used to point to other locations.
#
DocumentRoot "/var/www/html"

#
# Relax access to content within /var/www.
#
<Directory "/var/www">
    AllowOverride None
    # Allow open access:
    Require all granted
</Directory>

# Further relax access to the default document root:

^G Get Help      ^O WriteOut      ^R Read File     ^Y Prev Page     ^K Cut Text       ^C Cur Pos
^X Exit          ^J Justify        ^W Where Is      ^N Next Page     ^U UnCut Text    ^T To Spell
Right Ctrl
```

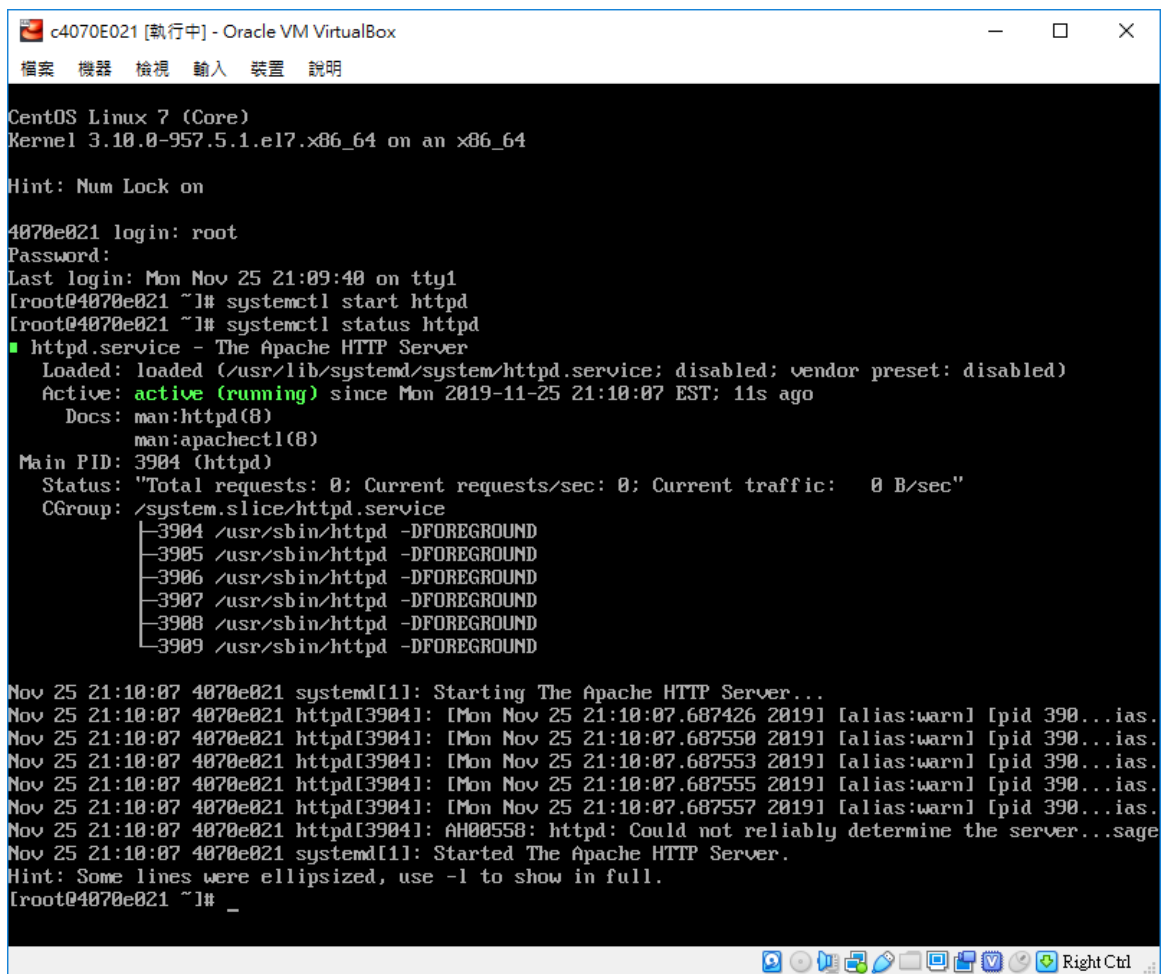
4. 編輯測試網頁 index.html



```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明
GNU nano 2.3.1 File: /var/www/html/index.html

<html>
Hello World!
</html>
```

5. 啟動 httpd, 檢視狀態



```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明

CentOS Linux 7 (Core)
Kernel 3.10.0-957.5.1.el7.x86_64 on an x86_64

Hint: Num Lock on

4070e021 login: root
Password:
Last login: Mon Nov 25 21:09:40 on tty1
[root@4070e021 ~]# systemctl start httpd
[root@4070e021 ~]# systemctl status httpd
■ httpd.service - The Apache HTTP Server
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; disabled; vendor preset: disabled)
   Active: active (running) since Mon 2019-11-25 21:10:07 EST; 11s ago
     Docs: man:httpd(8)
           man:apachectl(8)
  Main PID: 3904 (httpd)
    Status: "Total requests: 0; Current requests/sec: 0; Current traffic:  0 B/sec"
    CGroup: /system.slice/httpd.service
            └─3904 /usr/sbin/httpd -DFOREGROUND
              └─3905 /usr/sbin/httpd -DFOREGROUND
                └─3906 /usr/sbin/httpd -DFOREGROUND
                  └─3907 /usr/sbin/httpd -DFOREGROUND
                    └─3908 /usr/sbin/httpd -DFOREGROUND
                      └─3909 /usr/sbin/httpd -DFOREGROUND

Nov 25 21:10:07 4070e021 systemd[1]: Starting The Apache HTTP Server...
Nov 25 21:10:07 4070e021 httpd[3904]: [Mon Nov 25 21:10:07.687426 2019] [alias:warn] [pid 390...ias.
Nov 25 21:10:07 4070e021 httpd[3904]: [Mon Nov 25 21:10:07.687550 2019] [alias:warn] [pid 390...ias.
Nov 25 21:10:07 4070e021 httpd[3904]: [Mon Nov 25 21:10:07.687553 2019] [alias:warn] [pid 390...ias.
Nov 25 21:10:07 4070e021 httpd[3904]: [Mon Nov 25 21:10:07.687555 2019] [alias:warn] [pid 390...ias.
Nov 25 21:10:07 4070e021 httpd[3904]: [Mon Nov 25 21:10:07.687557 2019] [alias:warn] [pid 390...ias.
Nov 25 21:10:07 4070e021 httpd[3904]: AH00558: httpd: Could not reliably determine the server...sage
Nov 25 21:10:07 4070e021 systemd[1]: Started The Apache HTTP Server.
Hint: Some lines were ellipsized, use -l to show in full.
[root@4070e021 ~]# _
```

6. 瀏覽器測試 index.html

7. 安裝 php, php-fpm

```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明
php x86_64 5.4.16-46.1.el7_7 updates 1.4 M
Installing for dependencies:
php-cli x86_64 5.4.16-46.1.el7_7 updates 2.7 M
php-common x86_64 5.4.16-46.1.el7_7 updates 565 k

Transaction Summary
=====
Install 1 Package (+2 Dependent packages)

Total download size: 4.7 M
Installed size: 17 M
Downloading packages:
(1/3): php-common-5.4.16-46.1.el7_7.x86_64.rpm | 565 kB 00:00:00
(2/3): php-5.4.16-46.1.el7_7.x86_64.rpm | 1.4 MB 00:00:00
(3/3): php-cli-5.4.16-46.1.el7_7.x86_64.rpm | 2.7 MB 00:00:02
-----
Total 1.9 MB/s | 4.7 MB 00:00:02
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
Warning: RPMDB altered outside of yum.
Installing : php-common-5.4.16-46.1.el7_7.x86_64 1/3
Installing : php-cli-5.4.16-46.1.el7_7.x86_64 2/3
Installing : php-5.4.16-46.1.el7_7.x86_64 3/3
Verifying : php-common-5.4.16-46.1.el7_7.x86_64 1/3
Verifying : php-cli-5.4.16-46.1.el7_7.x86_64 2/3
Verifying : php-5.4.16-46.1.el7_7.x86_64 3/3

c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明
* centos-sclo-rh: ftp.ksu.edu.tw
* centos-sclo-sclo: ftp.ksu.edu.tw
* extras: ftp.ksu.edu.tw
* updates: ftp.ksu.edu.tw
Resolving Dependencies
--> Running transaction check
---> Package php-fpm.x86_64 0:5.4.16-46.1.el7_7 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

=====
Package Arch Version Repository Size
=====
Installing:
php-fpm x86_64 5.4.16-46.1.el7_7 updates 1.4 M

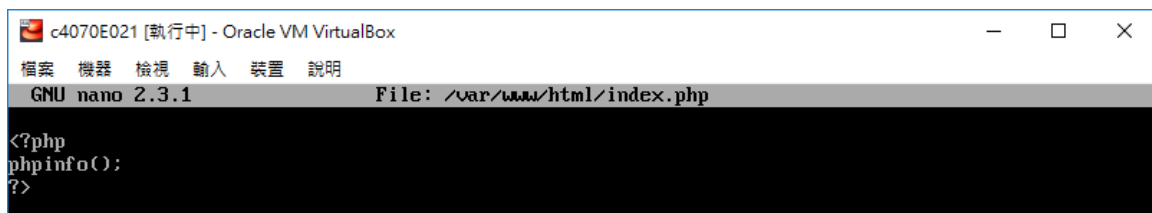
Transaction Summary
=====
Install 1 Package

Total download size: 1.4 M
Installed size: 4.5 M
Downloading packages:
php-fpm-5.4.16-46.1.el7_7.x86_64.rpm | 1.4 MB 00:00:00
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
Installing : php-fpm-5.4.16-46.1.el7_7.x86_64 1/1
Verifying : php-fpm-5.4.16-46.1.el7_7.x86_64 1/1

Installed:
php-fpm.x86_64 0:5.4.16-46.1.el7_7

Complete!
[root@4070e021 ~]# _
```

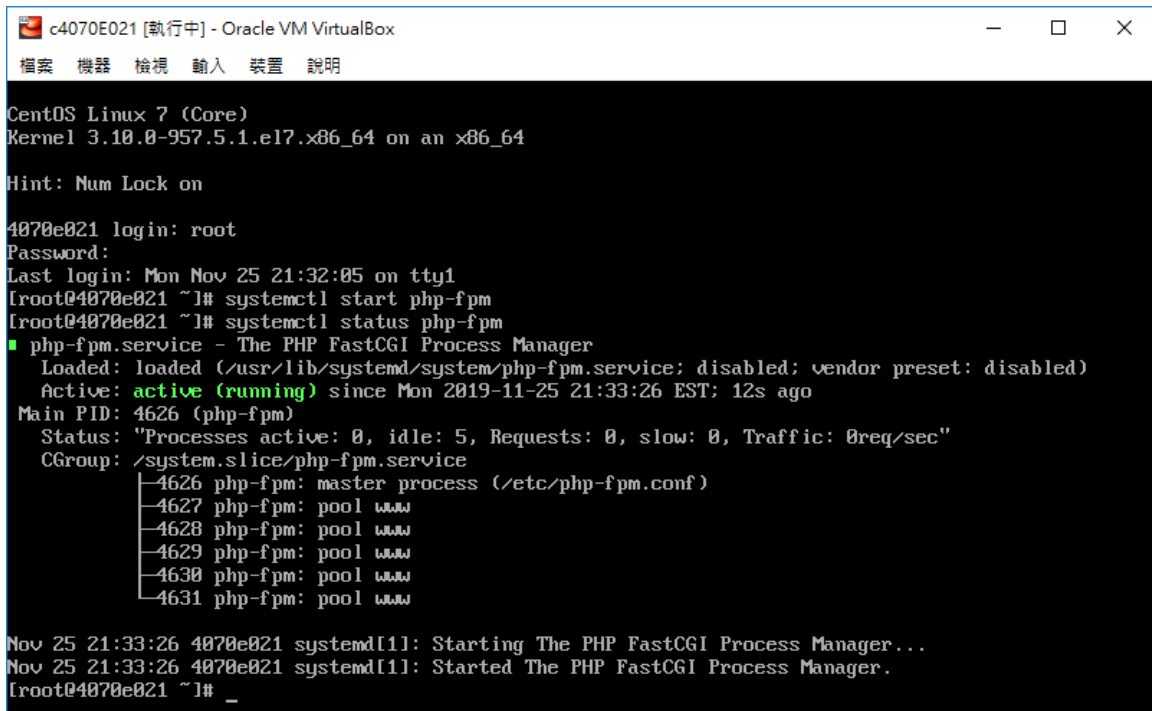
8. 編輯 index.php, 顯示 PHP 資訊



The screenshot shows a window titled 'c4070E021 [執行中] - Oracle VM VirtualBox'. Inside, the 'GNU nano 2.3.1' editor is open with the file '/var/www/html/index.php'. The visible code is:

```
<?php
phpinfo();
?>
```

9. 啟動 php-fpm, 檢視狀態



The screenshot shows a terminal window titled 'c4070E021 [執行中] - Oracle VM VirtualBox'. The terminal output is as follows:

```
CentOS Linux 7 (Core)
Kernel 3.10.0-957.5.1.el7.x86_64 on an x86_64

Hint: Num Lock on

4070e021 login: root
Password:
Last login: Mon Nov 25 21:32:05 on tty1
[root@4070e021 ~]# systemctl start php-fpm
[root@4070e021 ~]# systemctl status php-fpm
■ php-fpm.service - The PHP FastCGI Process Manager
   Loaded: loaded (/usr/lib/systemd/system/php-fpm.service; disabled; vendor preset: disabled)
   Active: active (running) since Mon 2019-11-25 21:33:26 EST; 12s ago
   Main PID: 4626 (php-fpm)
   Status: "Processes active: 0, idle: 5, Requests: 0, slow: 0, Traffic: 0req/sec"
   CGroup: /system.slice/php-fpm.service
           └─4626 php-fpm: master process (/etc/php-fpm.conf)
             └─4627 php-fpm: pool www
               └─4628 php-fpm: pool www
                 └─4629 php-fpm: pool www
                   └─4630 php-fpm: pool www
                     └─4631 php-fpm: pool www

Nov 25 21:33:26 4070e021 systemd[1]: Starting The PHP FastCGI Process Manager...
Nov 25 21:33:26 4070e021 systemd[1]: Started The PHP FastCGI Process Manager.
[root@4070e021 ~]# _
```

10. 瀏覽器測試 index.php

11. 安裝 dnf 套件管理程式

```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明

CentOS Linux 7 (Core)
Kernel 3.10.0-957.5.1.el7.x86_64 on an x86_64

Hint: Num Lock on

4070e021 login: root
Password:
Last login: Mon Nov 25 21:33:14 on tty1
[root@4070e021 ~]# yum -y install dnf
Loaded plugins: fastestmirror
Loading mirror speeds from cached hostfile
 * base: ftp.ksu.edu.tw
 * centos-sclo-rh: ftp.ksu.edu.tw
 * centos-sclo-scl: ftp.ksu.edu.tw
 * extras: ftp.ksu.edu.tw
 * updates: ftp.ksu.edu.tw
Package dnf-4.0.9.2-1.el7_6.noarch already installed and latest version
Nothing to do
[root@4070e021 ~]#
```

12. 移除 php-5.x

```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明

=====
Package Arch Version Repository Size
=====
Removing:
php x86_64 5.4.16-46.1.el7_7 @System 4.4 M
php-cli x86_64 5.4.16-46.1.el7_7 @System 8.8 M
php-common x86_64 5.4.16-46.1.el7_7 @System 3.8 M
php-fpm x86_64 5.4.16-46.1.el7_7 @System 4.5 M

Transaction Summary
=====
Remove 4 Packages

Freed space: 21 M
Running transaction check
Transaction check succeeded.
Running transaction test
Transaction test succeeded.
Running transaction
  Preparing : 1/1
  Erasing : php-5.4.16-46.1.el7_7.x86_64 1/4
  Erasing : php-cli-5.4.16-46.1.el7_7.x86_64 2/4
  Running scriptlet: php-fpm-5.4.16-46.1.el7_7.x86_64 3/4
  Erasing : php-fpm-5.4.16-46.1.el7_7.x86_64 3/4
  Running scriptlet: php-fpm-5.4.16-46.1.el7_7.x86_64 3/4
  Erasing : php-common-5.4.16-46.1.el7_7.x86_64 4/4
  Verifying : php-5.4.16-46.1.el7_7.x86_64 1/4
  Verifying : php-cli-5.4.16-46.1.el7_7.x86_64 2/4
  Verifying : php-common-5.4.16-46.1.el7_7.x86_64 3/4
  Verifying : php-fpm-5.4.16-46.1.el7_7.x86_64 4/4

Removed:
php-5.4.16-46.1.el7_7.x86_64 php-cli-5.4.16-46.1.el7_7.x86_64
php-common-5.4.16-46.1.el7_7.x86_64 php-fpm-5.4.16-46.1.el7_7.x86_64

Complete!
[root@4070e021 ~]#
```

13. 新增官方軟體選集的套件庫

```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明

CentOS Linux 7 (Core)
Kernel 3.10.0-957.5.1.el7.x86_64 on an x86_64

Hint: Num Lock on

4070e021 login: root
Password:
Last login: Mon Nov 25 22:00:39 on tty1
[root@4070e021 ~]# dnf -y install centos-release-scl
Last metadata expiration check: 1:31:25 ago on Mon 25 Nov 2019 08:31:09 PM EST.
Package centos-release-scl-2-3.el7.centos.noarch is already installed.
Dependencies resolved.
Nothing to do.
Complete!
[root@4070e021 ~]# ls /etc/yum.repos.d/
CentOS-Base.repo          CentOS-fasttrack.repo    CentOS-SCLo-scl-rh.repo  MariaDB.repo
CentOS-CR.repo            CentOS-Media.repo        CentOS-Sources.repo
CentOS-Debuginfo.repo    CentOS-SCLo-scl.repo     CentOS-Vault.repo
[root@4070e021 ~]#
```

14. 安裝 PHP 7.2

```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明

CentOS Linux 7 (Core)
Kernel 3.10.0-957.5.1.el7.x86_64 on an x86_64

Hint: Num Lock on

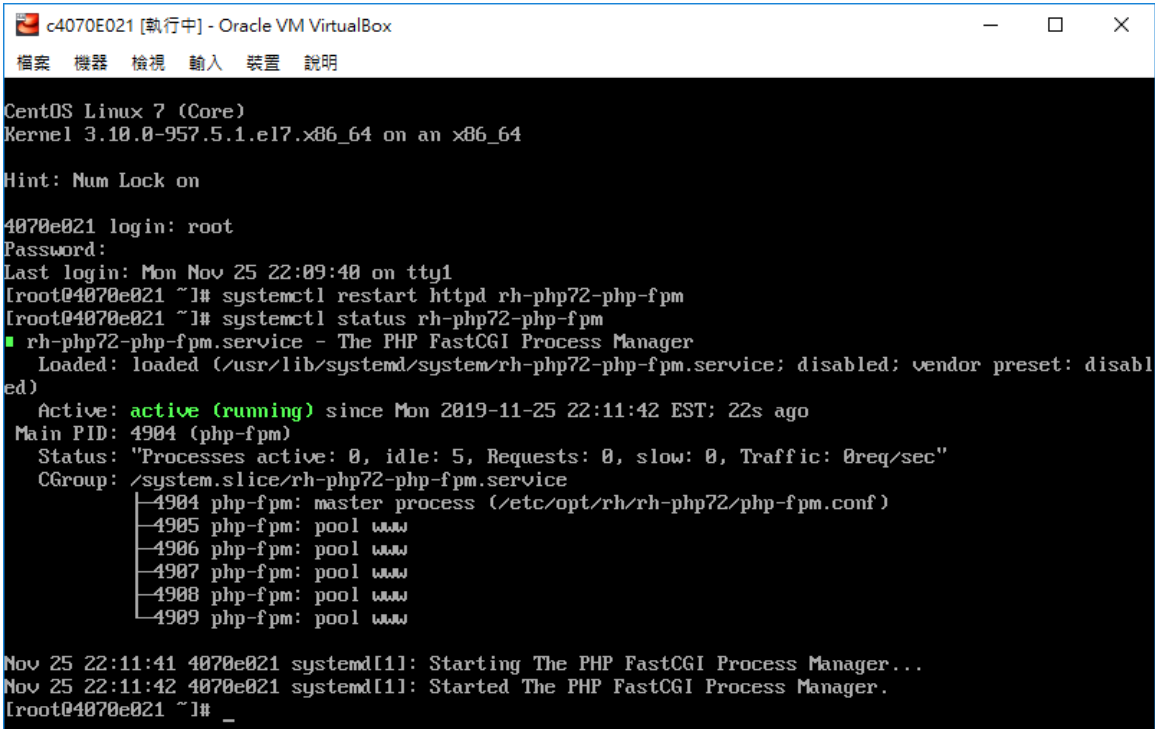
4070e021 login: root
Password:
Last login: Mon Nov 25 22:08:08 on tty1
[root@4070e021 ~]# dnf -y install rh-php72 rh-php72-php rh-php72-php-fpm
Last metadata expiration check: 1:38:35 ago on Mon 25 Nov 2019 08:31:09 PM EST.
Package rh-php72-1-2.el7.x86_64 is already installed.
Package rh-php72-php-7.2.10-3.el7.x86_64 is already installed.
Package rh-php72-php-fpm-7.2.10-3.el7.x86_64 is already installed.
Dependencies resolved.
Nothing to do.
Complete!
[root@4070e021 ~]#
```

15. 編輯 fpm.conf

```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明
GNU nano 2.3.1          File: /etc/httpd/conf.d/fpm.conf

ProxyPassMatch ^/(.php)$ fcgi://127.0.0.1:9000/var/www/html
Alias / /var/www/html
```


16. 重新啟動 service



```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明

CentOS Linux 7 (Core)
Kernel 3.10.0-957.5.1.el7.x86_64 on an x86_64

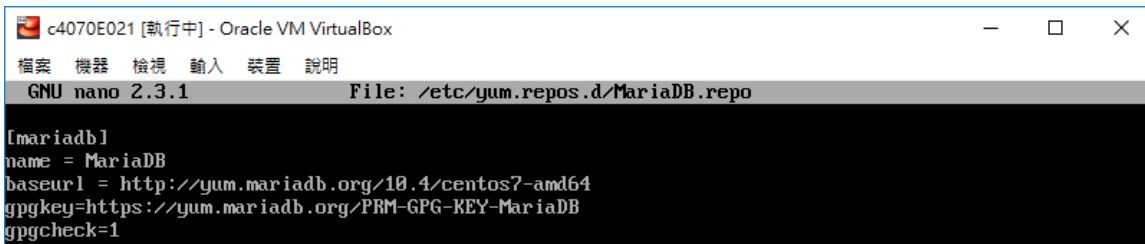
Hint: Num Lock on

4070E021 login: root
Password:
Last login: Mon Nov 25 22:09:40 on tty1
[root@4070E021 ~]# systemctl restart httpd rh-php72-php-fpm
[root@4070E021 ~]# systemctl status rh-php72-php-fpm
■ rh-php72-php-fpm.service - The PHP FastCGI Process Manager
   Loaded: loaded (/usr/lib/systemd/system/rh-php72-php-fpm.service; disabled; vendor preset: disabled)
   Active: active (running) since Mon 2019-11-25 22:11:42 EST; 22s ago
 Main PID: 4904 (php-fpm)
 Status: "Processes active: 0, idle: 5, Requests: 0, slow: 0, Traffic: 0req/sec"
   CGroup: /system.slice/rh-php72-php-fpm.service
           └─4904 php-fpm: master process (/etc/opt/rh/rh-php72/php-fpm.conf)
             └─4905 php-fpm: pool www
               └─4906 php-fpm: pool www
                 └─4907 php-fpm: pool www
                   └─4908 php-fpm: pool www
                     └─4909 php-fpm: pool www

Nov 25 22:11:41 4070E021 systemd[1]: Starting The PHP FastCGI Process Manager...
Nov 25 22:11:42 4070E021 systemd[1]: Started The PHP FastCGI Process Manager.
[root@4070E021 ~]#
```

17. 瀏覽器檢查 PHP 版本資訊

18. 新增 MariaDB 套件庫



```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明
GNU nano 2.3.1      File: /etc/yum.repos.d/MariaDB.repo

[mariadb]
name = MariaDB
baseurl = http://yum.mariadb.org/10.4/centos7-amd64
gpgkey=https://yum.mariadb.org/PRM-GPG-KEY-MariaDB
gpgcheck=1
```

19. 安裝 MariaDB 套件(sudo yum install mariadb-server)

```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明
perl-IO-Compress          noarch      2.061-2.el7          base          260 k
perl-Net-Daemon           noarch      0.48-5.el7           base          51 k
perl-PIRPC                noarch      0.2020-14.el7        base          36 k
rsync                     x86_64      3.1.2-6.el7_6.1      base          404 k

Transaction Summary
=====
Install 2 Packages (+13 Dependent packages)

Total download size: 52 M
Is this ok [y/d/N]: y
Downloading packages:
warning: /var/cache/yum/x86_64/7/mariadb/packages/MariaDB-common-10.4.10-1.el7.centos.x86_64.rpm: Header V4 DSA/SHA1 Signature, key ID 1bb943db: NOKEY
Public key for MariaDB-common-10.4.10-1.el7.centos.x86_64.rpm is not installed
(1/15): MariaDB-common-10.4.10-1.el7.centos.x86_64.rpm      | 81 kB  00:00:01
(2/15): MariaDB-compat-10.4.10-1.el7.centos.x86_64.rpm    | 2.8 MB 00:00:01
(3/15): boost-program-options-1.53.0-27.el7.x86_64.rpm    | 156 kB 00:00:00
(4/15): MariaDB-server-10.4.10-1.el7.centos.x86_64.rpm    | 26 MB  00:00:13
(5/15): MariaDB-client-10.4.10-1.el7.centos.x86_64.rpm    | 12 MB  00:00:17
(6/15): perl-Compress-Raw-Bzip2-2.061-3.el7.x86_64.rpm    | 32 kB  00:00:00
(7/15): lsof-4.87-6.el7.x86_64.rpm                        | 331 kB 00:00:00
(8/15): perl-DBI-1.627-4.el7.x86_64.rpm                   | 802 kB 00:00:00
(9/15): perl-Data-Dumper-2.145-3.el7.x86_64.rpm           | 47 kB  00:00:00
(10/15): perl-IO-Compress-2.061-2.el7.noarch.rpm           | 260 kB 00:00:00
(11/15): perl-Net-Daemon-0.48-5.el7.noarch.rpm            | 51 kB  00:00:00
(12/15): perl-PIRPC-0.2020-14.el7.noarch.rpm              | 36 kB  00:00:00
(13/15): perl-Compress-Raw-Zlib-2.061-4.el7.x86_64.rpm    | 57 kB  00:00:00
(14/15): rsync-3.1.2-6.el7_6.1.x86_64.rpm                 | 404 kB 00:00:00
(15/15): galera-4-26.4.3-1.rhel7.el7.centos.x86_64.rpm   | 9.3 MB 00:00:04
-----
Total                                                                2.4 MB/s | 52 MB 00:00:21
Retrieving key from https://yum.mariadb.org/PRM-GPG-KEY-MariaDB

GPG key retrieval failed: [Errno 14] HTTPS Error 404 - Not Found
[root@4070e021 ~]# _
```

20. 啟動 mariadb

```
c4070E021 [執行中] - Oracle VM VirtualBox
檔案 機器 檢視 輸入 裝置 說明

CentOS Linux 7 (Core)
Kernel 3.10.0-957.5.1.el7.x86_64 on an x86_64

Hint: Num Lock on

4070e021 login: root
Password:
Last login: Mon Nov 25 22:29:35 on tty1
[root@4070e021 ~]# systemctl start mariadb
Failed to start mariadb.service: Unit not found.
[root@4070e021 ~]# systemctl status mariadb
Unit mariadb.service could not be found.
[root@4070e021 ~]# _
```

21. 設定資料庫, 執行 `mysql_secure_installation`

22. 輸入資料庫 `root` 使用者密碼

23. 刪除匿名使用者不允許 `root` 遠端登入資料庫

24. 刪除測試資料庫重新載入權限資料表

25. 測試 MariaDB 資料庫

26. 網頁應用程式之安全性