SSL憑證安裝與申請
Let’s Encrypt

臺灣大學計資中心
網路組
游子興

大綱

* Let’s Encrypt
* Certbot Install
* Get and Install Certificate for Apache
* Get Certificate only for Apache
* Standalone
* Webroot
* Wildcard Certificates

Let’s Encrypt

Let's Encrypt

* Let‘s Encrypt 是免費、自動化和開放的憑證頒發機構，由非營利組織網路安全研究小組 (Internet Security Research Group, ISRG) 營運。
* https://letsencrypt.org/sponsors/

* 參考資料
  * https://letsencrypt.org/getting-started/

Automatic Certificate Management Environment (ACME) Protocol

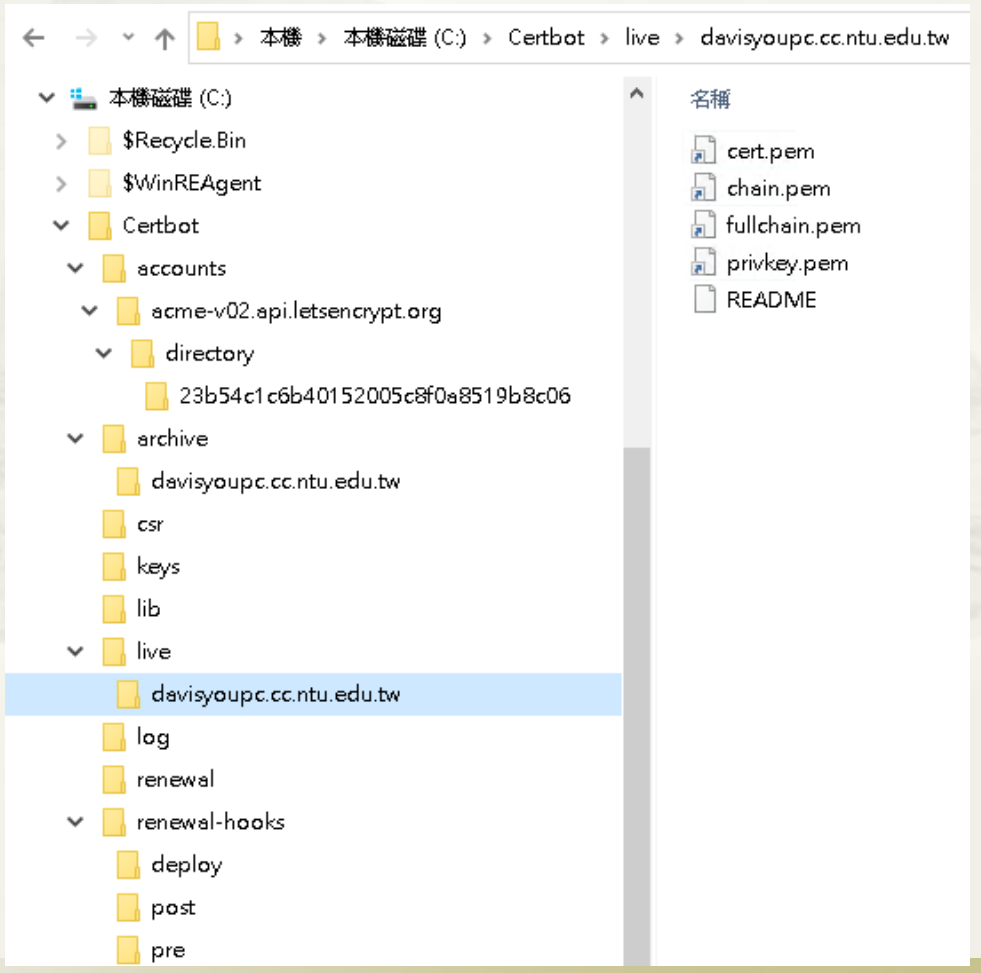
- Designed by the Internet Security Research Group (ISRG) for their Let's Encrypt service.
- Use ACME protocol to verify that you control a given domain name and to issue you a certificate. To get a Let’s Encrypt certificate, you’ll need to choose a piece of ACME client software to use.
- The ACME clients by third parties.
  - https://letsencrypt.org/docs/client-options/
  - Recommended: Certbot

Certbot

- Command Line 自動化安裝工具
  - https://certbot.eff.org/docs/
  - https://eff-certbot.readthedocs.io/en/stable/using.html#certbot-command-line-options
- Linux : requires Python 3.6+
- It requires root/administrator access

Certbot Config Files Save Path

- Linux
  - /etc/letsencrypt
  - /var/log/letsencrypt
  - /var/lib/letsencrypt
- 還原成初始設定
  - 刪除上述路徑及檔案
- Windows: C:\Certbot



Certbot Plugins

* Authenticators
  * automatically perform the steps to prove that you control the domain to get the certificate.
* Installers
  * automatically modify web server's configuration to install the certificate.
* Some plugins are both authenticators and installers

Authenticators 執行動作

- 產生驗證檔案
  - Web 根目錄 /.well-known/acme-challenge/RpUCT8SSJN77t7mZBHkI6_BLhtIm13LyFVzHJ1mhcKI
- From Internet 存取上述檔案
  - http://x.x.x.x/.well-known/acme-challenge/...
- Create Private Key and Certificates
  - /etc/letsencrypt/live/[certificate_name]/
    - cert.pem chain.pem fullchain.pem privkey.pem

Installers 執行動作

* Enable SSL Module
  * a2enmod ssl
* Create apache config
  * /etc/apache2/sites-available/000-default-le-ssl.conf
  * /etc/apache2/sites-enabled/000-default-le-ssl.conf

Certbot Plugin List (Official)

Plugin	Auth	Inst	Notes	Challenge types (port)
apache	Y	Y	Apache.	http (80)
nginx	Y	Y	Nginx.	http (80)
webroot	Y	N	Get certificate by writing to the webroot directory of an already running webserver.	http (80)
standalone	Y	N	For systems without webserver. (本身即是 Webserver)	http (80)
DNS plugins	Y	N	Get certificate by modifying DNS records to prove you have control over a domain. Domain validation is the only way to get wildcard certificates.	dns (53)
manual	Y	N		http (80) or dns (53)

Third-party Plugins

* https://certbot.eff.org/docs/using.html#third-party-plugins

Plugin	Auth	Inst	Notes
haproxy	Y	Y	Integration with the HAProxy load balancer
s3front	Y	Y	Integration with Amazon CloudFront distribution of S3 buckets
gandi	Y	N	Obtain certificates via the Gandi LiveDNS API
varnish	Y	N	Obtain certificates via a Varnish server
external-auth	Y	Y	A plugin for convenient scripting
pritunl	N	Y	Install certificates in pritunl distributed OpenVPN servers
proxmox	N	Y	Install certificates in Proxmox Virtualization servers
dns-standalone	Y	N	Obtain certificates via an integrated DNS server
dns-ispconfig	Y	N	DNS Authentication using ISPConfig as DNS server
dns-clouddns	Y	N	DNS Authentication using CloudDNS API
dns-lightsail	Y	N	DNS Authentication using Amazon Lightsail DNS API
dns-inwx	Y	Y	DNS Authentication for INWX through the XML API
dns-azure	Y	N	DNS Authentication using Azure DNS
dns-godaddy	Y	N	DNS Authentication using Godaddy DNS
njalla	Y	N	DNS Authentication for njalla
DuckDNS	Y	N	DNS Authentication for DuckDNS
Porkbun	Y	N	DNS Authentication for Porkbun
Infomaniak	Y	N	DNS Authentication using Infomaniak Domains API

Default Installed Plugins

- ~# certbot plugins
- Snap Install

```
root@vm-ubuntu-cc411:~# certbot plugins
Saving debug log to /var/log/letsencrypt/letsencrypt.log

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
* apache
Description: Apache Web Server plugin
Interfaces: Installer, Authenticator, Plugin
Entry point: apache = certbot_apache._internal.entrypoint:ENTRYPOINT

* nginx
Description: Nginx Web Server plugin
Interfaces: Installer, Authenticator, Plugin
Entry point: nginx = certbot_nginx._internal.configurator:NginxConfigurator

* standalone
Description: Spin up a temporary webserver
Interfaces: Authenticator, Plugin
Entry point: standalone = certbot._internal.plugins.standalone:Authenticator

* webroot
Description: Place files in webroot directory
Interfaces: Authenticator, Plugin
Entry point: webroot = certbot._internal.plugins.webroot:Authenticator
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

- Pip Install

```
root@vm-ubuntu-cc411:~# certbot plugins
Saving debug log to /var/log/letsencrypt/letsencrypt.log

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
* standalone
Description: Spin up a temporary webserver
Interfaces: Authenticator, Plugin
Entry point: standalone = certbot._internal.plugins.standalone:Authenticator

* webroot
Description: Place files in webroot directory
Interfaces: Authenticator, Plugin
Entry point: webroot = certbot._internal.plugins.webroot:Authenticator
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

- Windows

```
C:\Windows\system32>certbot plugins
Saving debug log to C:\Certbot\log\letsencrypt.log

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
* standalone
Description: Spin up a temporary webserver
Interfaces: Authenticator, Plugin
Entry point: standalone = certbot._internal.plugins.standalone:Authenticator

* webroot
Description: Place files in webroot directory
Interfaces: Authenticator, Plugin
Entry point: webroot = certbot._internal.plugins.webroot:Authenticator
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

Certbot Install

use snap for Linux

- Install Snap
  - sudo snap install core
  - sudo snap refresh core
- Install Certbot
  - sudo snap install --classic certbot
  - sudo ln -s /snap/bin/certbot /usr/bin/certbot
- Install Plugin (不支援 Third-party plugins)
  - Confirm plugin containment level
    - sudo snap set certbot trust-plugin-with-root=ok
  - Install
    - sudo snap install certbot-dns-rfc2136

use pip for Linux

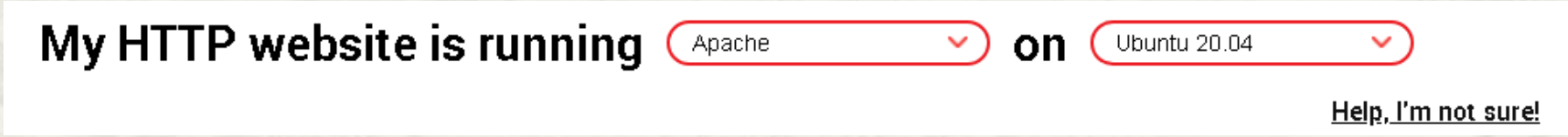
- Install system dependency
  - Debian, Ubuntu
    - sudo apt install python3 python3-venv libaugeas0
  - Fedora, CentOS
    - sudo dnf install python3 augeas-libs
- Set up a Python virtual environment
  - sudo python3 -m venv /opt/certbot/
  - sudo /opt/certbot/bin/pip install --upgrade pip
- Install Certbot
  - sudo /opt/certbot/bin/pip install certbot
  - ln -s /opt/certbot/bin/certbot /usr/bin/certbot
- Install Plugin (支援 Third-party plugins)
  - sudo /opt/certbot/bin/pip install certbot-apache
  - sudo /opt/certbot/bin/pip install certbot-dns-standalone

Certbot for Windows

- Download & Install
  - https://dl.eff.org/certbot-beta-installer-win32.exe
  - Install @ C:\Program Files (x86)\Certbot
- Run
  - run CMD.EXE “Run as administrator”
- Currently unable to automatically renew wildcard certificates, since these require a DNS plugin in order to be renewed without user intervention.
  - https://certbot.eff.org/lets-encrypt/windows-apache

Get and Install Certificate for Apache

https://certbot.eff.org/lets-encrypt/ubuntufocal-apache



全自動安裝
(不需先 Enable SSL Module)

- sudo certbot --apache
  - Saving debug log to /var/log/letsencrypt/letsencrypt.log
  - Enter email address (used for urgent renewal and security notices)
  - (Enter 'c' to cancel): yourname@ntu.edu.tw
  - ---
  - Please read the Terms of Service at
  - https://letsencrypt.org/documents/LE-SA-v1.2-November-15-2017.pdf. You must
  - agree in order to register with the ACME server. Do you agree?
  - ---
  - (Y)es/(N)o: Y
  - ---
  - Would you be willing, once your first certificate is successfully issued, to
  - share your email address with the Electronic Frontier Foundation, a founding
  - partner of the Let's Encrypt project and the non-profit organization that
  - develops Certbot? We'd like to send you email about our work encrypting the web,
  - EFF news, campaigns, and ways to support digital freedom.
  - ---
  - (Y)es/(N)o: N
  - Account registered.
  - Please enter the domain name(s) you would like on your certificate (comma and/or
  - space separated) (Enter 'c' to cancel): xyz.ntu.edu.tw
  - Requesting a certificate for xyz.ntu.edu.tw

全自動安裝

* Successfully received certificate.
* Certificate is saved at: /etc/letsencrypt/live/xyz.ntu.edu.tw/fullchain.pem
* Key is saved at: /etc/letsencrypt/live/xyz.ntu.edu.tw/privkey.pem
* This certificate expires on 2021-10-13.
* These files will be updated when the certificate renews.
* Certbot has set up a scheduled task to automatically renew this certificate in the background.

* Deploying certificate
* Successfully deployed certificate for tanet2020.tp1rc.edu.tw to /etc/apache2/sites-available/000-default-le-ssl.conf
* Congratulations! You have successfully enabled HTTPS on https://xyz.ntu.edu.tw

* -
* If you like Certbot, please consider supporting our work by:
* * Donating to ISRG / Let's Encrypt: https://letsencrypt.org/donate
* * Donating to EFF: https://eff.org/donate-le
* -

Get Certificate only for Apache

Get Certificate only for Apache

* ~# certbot certonly --apache

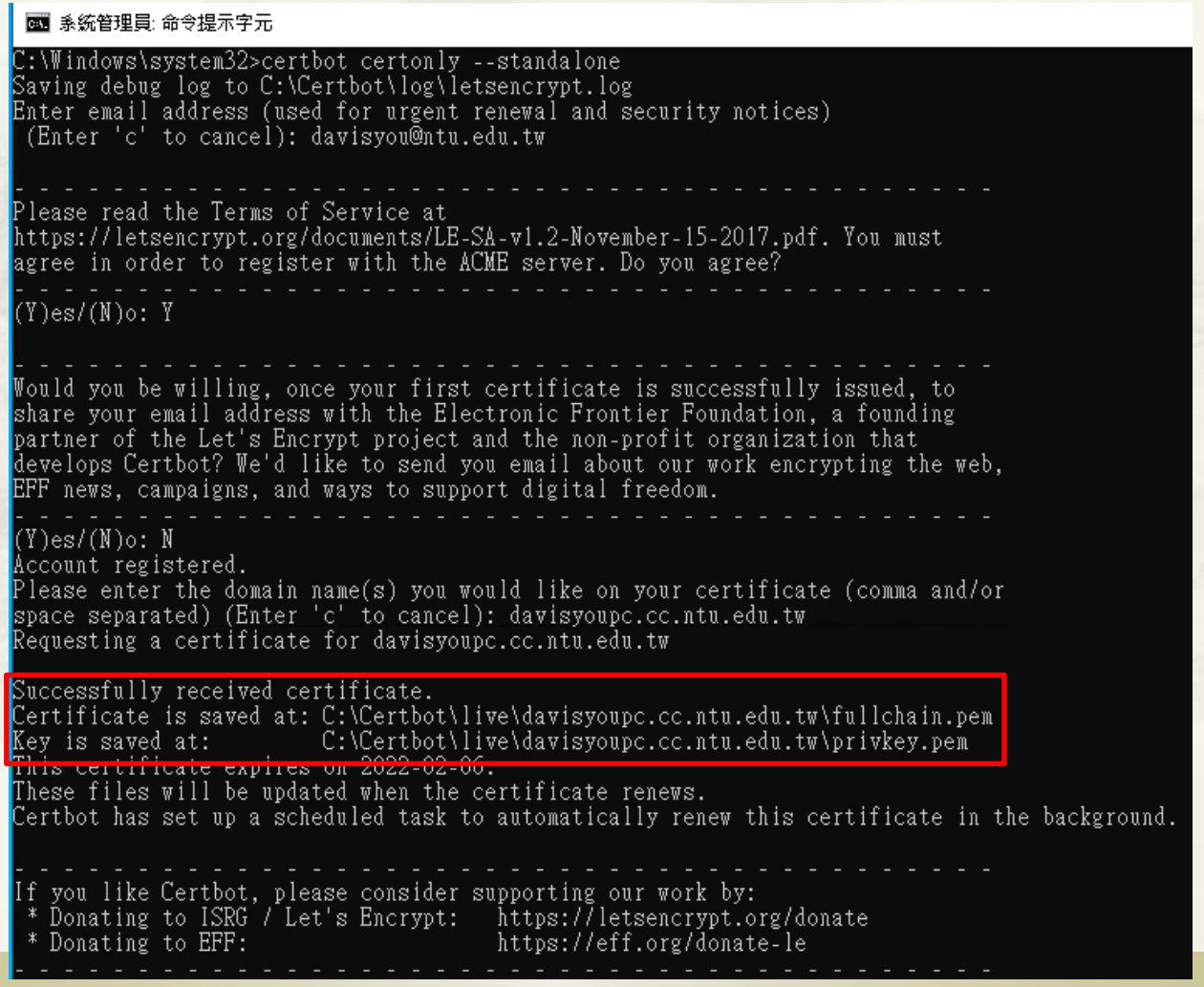
```
root@vm-ubuntu-cc411:~# certbot certonly --apache
Saving debug log to /var/log/letsencrypt/letsencrypt.log
Enter email address (used for urgent renewal and security notices)
 (Enter 'c' to cancel): davisyou@ntu.edu.tw

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Please read the Terms of Service at
https://letsencrypt.org/documents/LE-SA-v1.2-November-15-2017.pdf. You must
agree in order to register with the ACME server. Do you agree?
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
(Y)es/(N)o: Y

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Would you be willing, once your first certificate is successfully issued, to
share your email address with the Electronic Frontier Foundation, a founding
partner of the Let's Encrypt project and the non-profit organization that
develops Certbot? We'd like to send you email about our work encrypting the web,
EFF news, campaigns, and ways to support digital freedom.
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
(Y)es/(N)o: N
Account registered.
Please enter the domain name(s) you would like on your certificate (comma and/or
space separated) (Enter 'c' to cancel): davisyoupc.cc.ntu.edu.tw
Requesting a certificate for davisyoupc.cc.ntu.edu.tw

Successfully received certificate.
Certificate is saved at: /etc/letsencrypt/live/davisyoupc.cc.ntu.edu.tw/fullchain.pem
Key is saved at:         /etc/letsencrypt/live/davisyoupc.cc.ntu.edu.tw/privkey.pem
This certificate expires on 2022-02-07.
These files will be updated when the certificate renews.
Certbot has set up a scheduled task to automatically renew this certificate in the background.
```

Standalone

No web server currently running

Standalone for Windows

* > certbot certonly --standalone



Standalone for Ubuntu

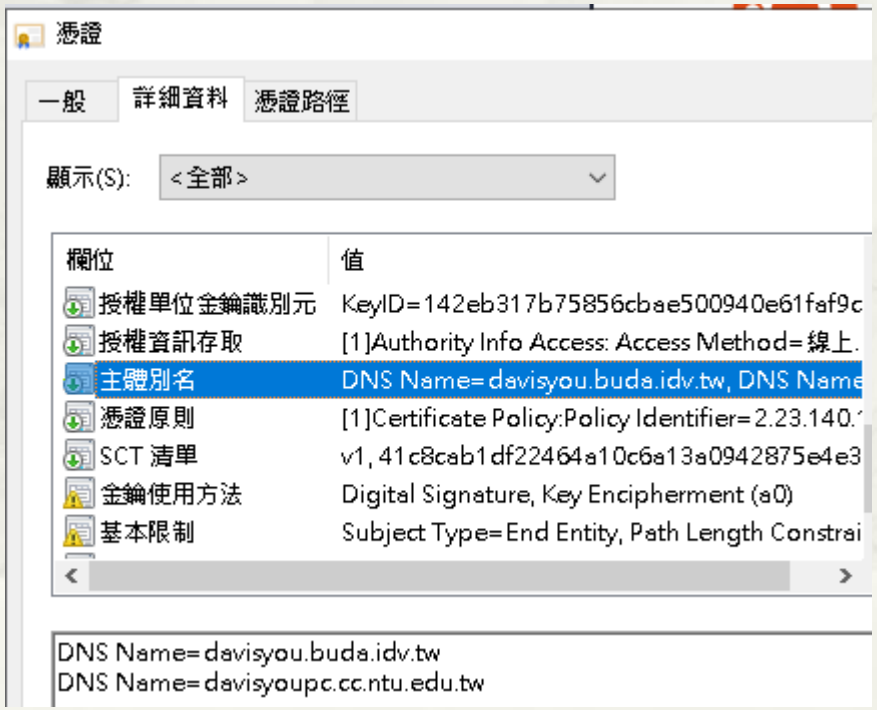
```
root@vm-ubuntu-cc411:~# certbot certonly --standalone
Saving debug log to /var/log/letsencrypt/letsencrypt.log
Enter email address (used for urgent renewal and security notices)
 (Enter 'c' to cancel): davisyou@ntu.edu.tw

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Please read the Terms of Service at
https://letsencrypt.org/documents/LE-SA-v1.2-November-15-2017.pdf. You must
agree in order to register with the ACME server. Do you agree?
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
(Y)es/(N)o: Y

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Would you be willing, once your first certificate is successfully issued, to
share your email address with the Electronic Frontier Foundation, a founding
partner of the Let's Encrypt project and the non-profit organization that
develops Certbot? We'd like to send you email about our work encrypting the web,
EFF news, campaigns, and ways to support digital freedom.
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
(Y)es/(N)o: N
Account registered.
Please enter the domain name(s) you would like on your certificate (comma and/or
space separated) (Enter 'c' to cancel): davisyoupc.cc.ntu.edu.tw,davisyou.buda.idv.tw
Requesting a certificate for davisyoupc.cc.ntu.edu.tw and davisyou.buda.idv.tw
```

2 domain names

```
Successfully received certificate.
Certificate is saved at: /etc/letsencrypt/live/davisyoupc.cc.ntu.edu.tw/fullchain.pem
Key is saved at:         /etc/letsencrypt/live/davisyoupc.cc.ntu.edu.tw/privkey.pem
This certificate expires on 2022-02-07.
These files will be updated when the certificate renews.
```

Standalone for Ubuntu

* https://crt.sh/?id=5572136554
  * X509v3 Subject Alternative Name:
  * DNS:davisyou.buda.idv.tw
  * DNS:davisyoupc.cc.ntu.edu.tw



Webroot

Already have web server running(port 80)

Webroot
Apache for Linux

* ~# certbot certonly --webroot

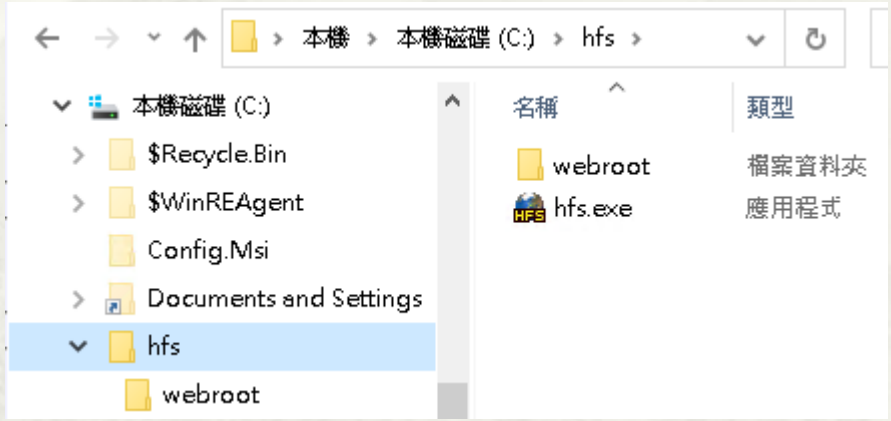
```
root@vm-ubuntu-cc411:~# certbot certonly --webroot
Saving debug log to /var/log/letsencrypt/letsencrypt.log
Enter email address (used for urgent renewal and security notices)
 (Enter 'c' to cancel): davisyou@ntu.edu.tw

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Please read the Terms of Service at
https://letsencrypt.org/documents/LE-SA-v1.2-November-15-2017.pdf. You must
agree in order to register with the ACME server. Do you agree?
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
(Y)es/(N)o: Y

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Would you be willing, once your first certificate is successfully issued, to
share your email address with the Electronic Frontier Foundation, a founding
partner of the Let's Encrypt project and the non-profit organization that
develops Certbot? We'd like to send you email about our work encrypting the web,
EFF news, campaigns, and ways to support digital freedom.
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
(Y)es/(N)o: N
Account registered.
Please enter the domain name(s) you would like on your certificate (comma and/or
space separated) (Enter 'c' to cancel): davisyoupc.cc.ntu.edu.tw
Requesting a certificate for davisyoupc.cc.ntu.edu.tw
Input the webroot for davisyoupc.cc.ntu.edu.tw: (Enter 'c' to cancel): /var/www/html

Successfully received certificate.
Certificate is saved at: /etc/letsencrypt/live/davisyoupc.cc.ntu.edu.tw/fullchain.pem
Key is saved at:         /etc/letsencrypt/live/davisyoupc.cc.ntu.edu.tw/privkey.pem
This certificate expires on 2022-02-08.
These files will be updated when the certificate renews.
```

Webroot
Apache Access Log

- tail /var/log/apache2/access.log
  - 34.219.87.132 - - [10/Nov/2021:09:02:29 +0800] "GET /.well-known/acme-challenge/7JzOS0u7VYWoU6zBvTQkVvcMESdcWRAY2mrhXyX1dIE HTTP/1.1" 200 308 "-" "Mozilla/5.0 (compatible; Let's Encrypt validation server; +https://www.letsencrypt.org)"
  - 64.78.149.164 - - [10/Nov/2021:09:02:29 +0800] "GET /.well-known/acme-challenge/7JzOS0u7VYWoU6zBvTQkVvcMESdcWRAY2mrhXyX1dIE HTTP/1.1" 200 308 "-" "Mozilla/5.0 (compatible; Let's Encrypt validation server; +https://www.letsencrypt.org)"
  - 3.142.122.14 - - [10/Nov/2021:09:02:30 +0800] "GET /.well-known/acme-challenge/7JzOS0u7VYWoU6zBvTQkVvcMESdcWRAY2mrhXyX1dIE HTTP/1.1" 200 308 "-" "Mozilla/5.0 (compatible; Let's Encrypt validation server; +https://www.letsencrypt.org)"
  - 18.159.196.172 - - [10/Nov/2021:09:02:31 +0800] "GET /.well-known/acme-challenge/7JzOS0u7VYWoU6zBvTQkVvcMESdcWRAY2mrhXyX1dIE HTTP/1.1" 200 308 "-" "Mozilla/5.0 (compatible; Let's Encrypt validation server; +https://www.letsencrypt.org)"

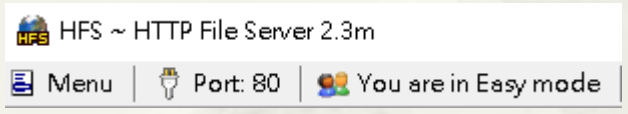
Webroot
HFS Web Server for Windows

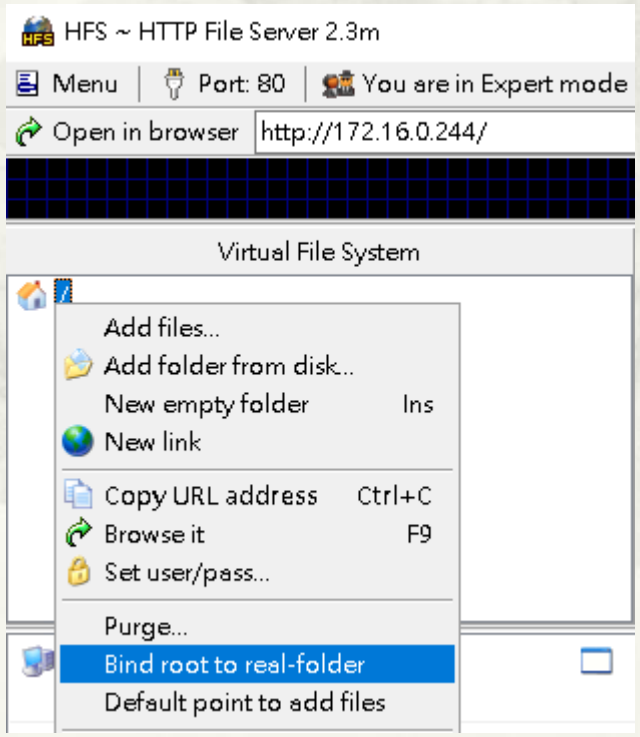
* HFS Web Server download
  * https://www.rejetto.com/hfs/?f=dl

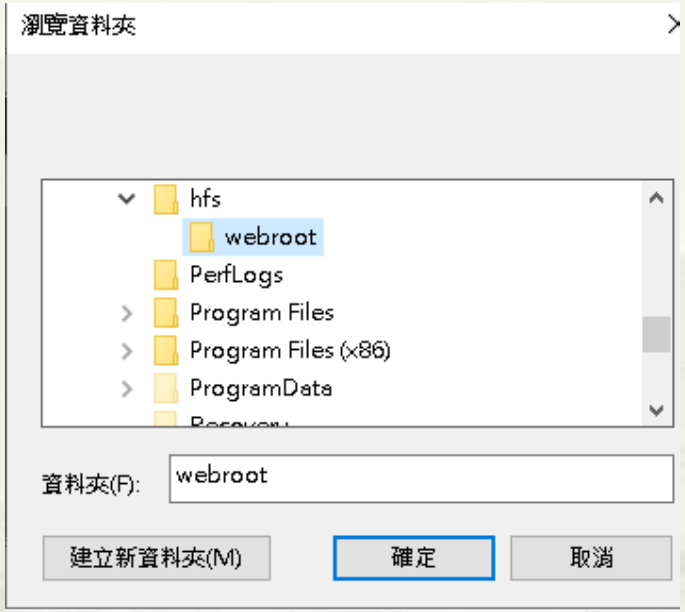


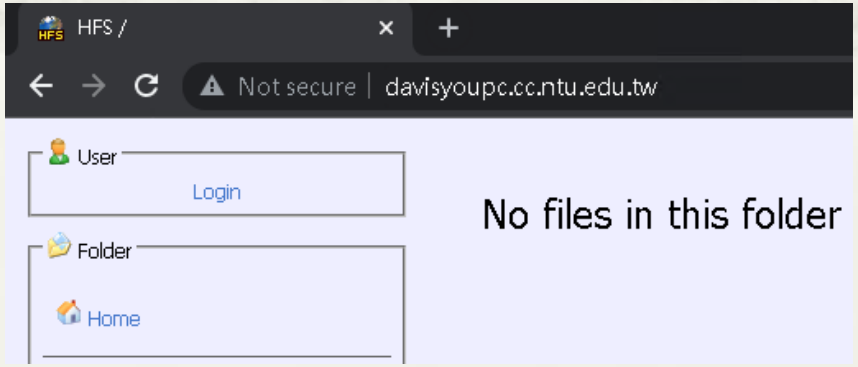
HFS
Root Folder Setup

* Switch to Expert Mode



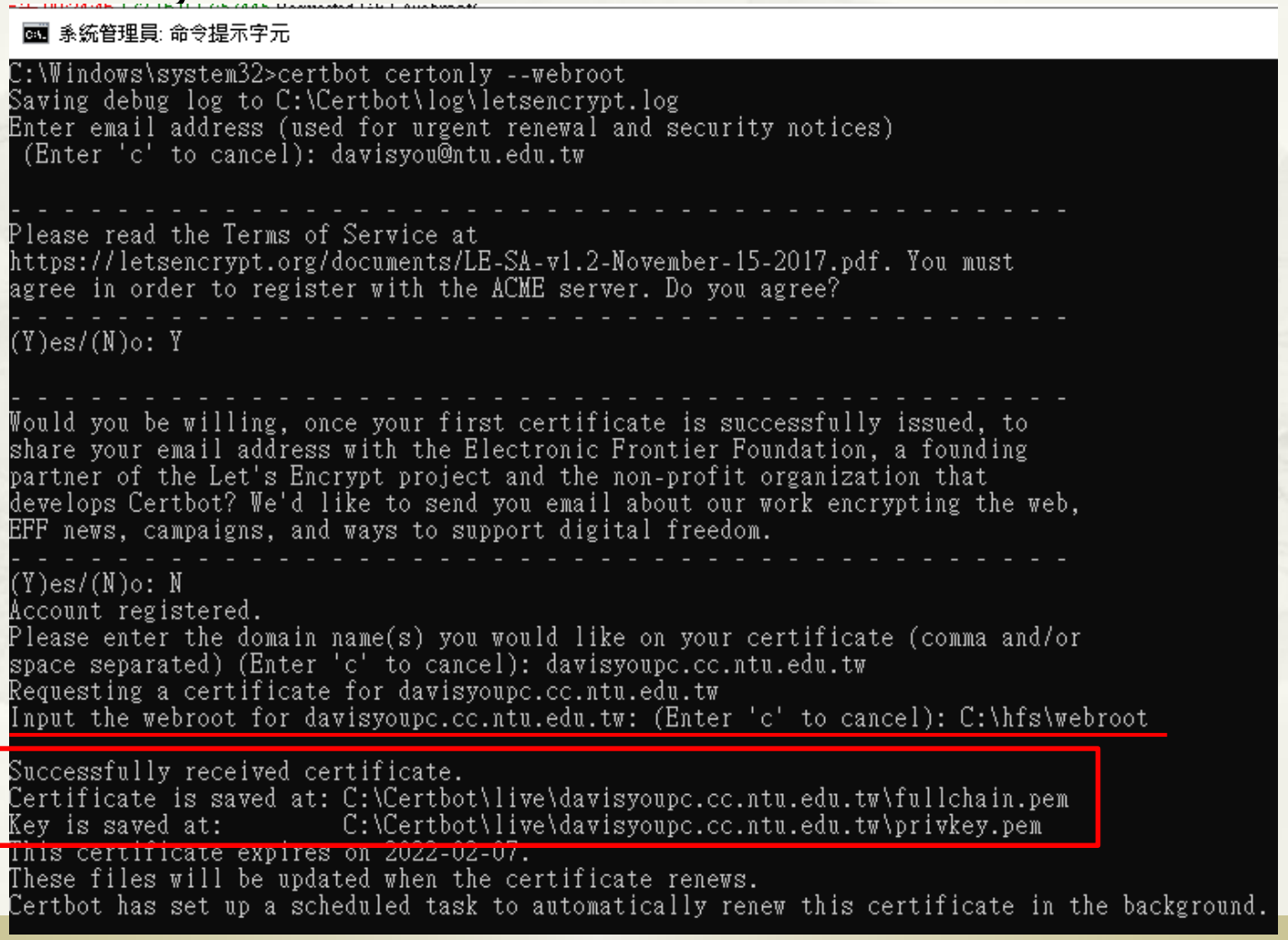






Webroot
HFS Web Server for Windows

* > certbot certonly --webroot



HFS Access Log

```
上午 09:36:00 64.78.149.164:23096 Requested GET /.well-known/acme-challenge/cCuV_qJLe3KB3FZNGOPnce0XXN5udNL0CcW_1-4Yu_I
上午 09:36:00 64.78.149.164:23096 Fully downloaded - 87 @ 5.3 KB/s - /.well-known/acme-challenge/cCuV_qJLe3KB3FZNGOPnce0XXN5udNL0CcW_1-4Yu_I
上午 09:36:00 34.219.87.132:34512 Requested GET /.well-known/acme-challenge/cCuV_qJLe3KB3FZNGOPnce0XXN5udNL0CcW_1-4Yu_I
上午 09:36:00 34.219.87.132:34512 Fully downloaded - 87 @ 5.7 KB/s - /.well-known/acme-challenge/cCuV_qJLe3KB3FZNGOPnce0XXN5udNL0CcW_1-4Yu_I
上午 09:36:02 18.192.36.99:24774 Requested GET /.well-known/acme-challenge/cCuV_qJLe3KB3FZNGOPnce0XXN5udNL0CcW_1-4Yu_I
上午 09:36:02 18.192.36.99:24774 Fully downloaded - 87 @ 5.3 KB/s - /.well-known/acme-challenge/cCuV_qJLe3KB3FZNGOPnce0XXN5udNL0CcW_1-4Yu_I
上午 09:36:02 18.116.86.117:12790 Requested GET /.well-known/acme-challenge/cCuV_qJLe3KB3FZNGOPnce0XXN5udNL0CcW_1-4Yu_I
上午 09:36:02 18.116.86.117:12790 Fully downloaded - 87 @ 0B/s - /.well-known/acme-challenge/cCuV_qJLe3KB3FZNGOPnce0XXN5udNL0CcW_1-4Yu_I
```

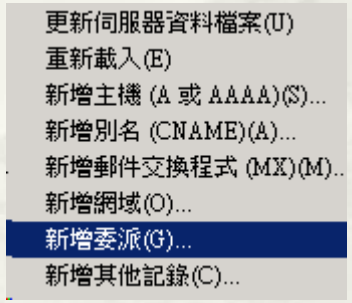
Wildcard Certificate

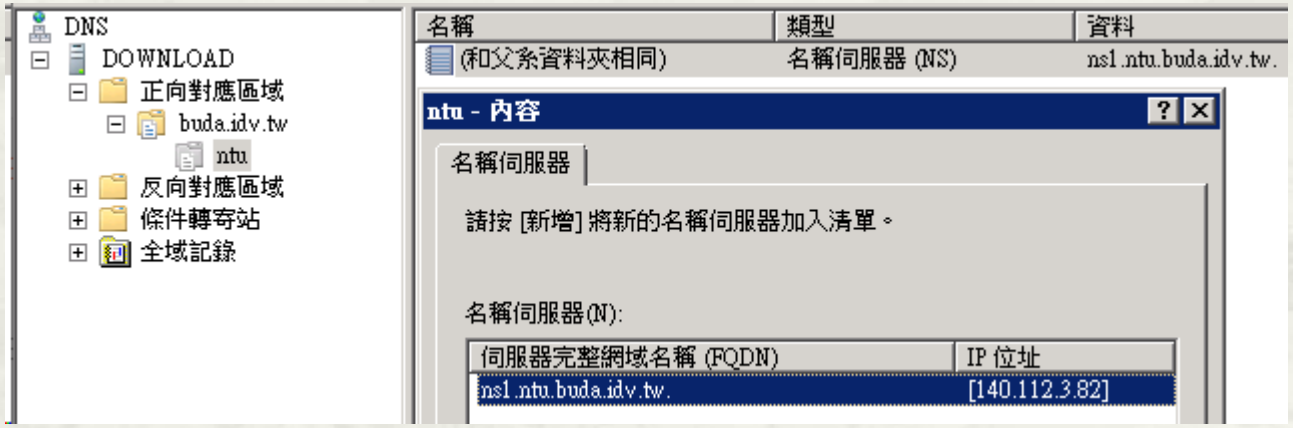
DNS Plugin

- certbot-dns-rfc2136
  - Support DNS server with RFC 2136 Dynamic Updates.
  - https://certbot-dns-rfc2136.readthedocs.io/en/stable/
  - BIND
- certbot-dns-standalone (Third-party)
  - https://github.com/siilike/certbot-dns-standalone
  - 本身即是 DNS Server

certbot-dns-standalone

* Windows DNS Setup





certbot-dns-standalone

* ~# certbot certonly

```
root@vm-ubuntu-cc411:~# certbot certonly
Saving debug log to /var/log/letsencrypt/letsencrypt.log

How would you like to authenticate with the ACME CA?
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
1: Apache Web Server plugin (apache)
2: Obtain certificates using an integrated DNS server (dns-standalone)
3: Spin up a temporary webserver (standalone)
4: Place files in webroot directory (webroot)
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Select the appropriate number [1-4] then [enter] (press 'c' to cancel): 2
Please enter the domain name(s) you would like on your certificate (comma and/or
space separated) (Enter 'c' to cancel): *.ntu.buda.idv.tw
Requesting a certificate for *.ntu.buda.idv.tw
Waiting 0 seconds for DNS changes to propagate

Successfully received certificate.
Certificate is saved at: /etc/letsencrypt/live/ntu.buda.idv.tw/fullchain.pem
Key is saved at:         /etc/letsencrypt/live/ntu.buda.idv.tw/privkey.pem
This certificate expires on 2022-02-08.
These files will be updated when the certificate renews.
```

憑證更新

certbot renew

憑證更新

- renew certificate less than 30 days.
- Use the same plugin and options that the certificate was originally issued

- ~# certbot renew
  - Saving debug log to /var/log/letsencrypt/letsencrypt.log
  -
  - Processing /etc/letsencrypt/renewal/tanet2020.tp1rc.edu.tw.conf
  -
  - Certificate not yet due for renewal
  -
  - The following certificates are not due for renewal yet:
  - /etc/letsencrypt/live/tanet2020.tp1rc.edu.tw/fullchain.pem expires on 2021-10-04 (skipped)
  - No renewals were attempted.

- certbot renew --dry-run
- certbot renew --quiet
  - silence all output except errors
- if you have a single certificate obtained using the standalone plugin
  - certbot renew --pre-hook "service nginx stop" --post-hook "service nginx start“
  - hook to run only after a successful renewal, use --deploy-hook

簡報完畢
謝謝