Becoming a (Tiny) Certificate Authority

It's kind of ridiculous how easy it is to generate the files needed to become a certificate authority. It really only takes two commands. Let's dive into how we can do this on macOS and Linux, and then look at how it works in the Windows operating system.

Generating the Private Key and Root Certificate on macOS Monterey and Linux

As macOS and Linux are both Unix-like operating systems, the processes for generating the required files are identical.

The only real difference between the two is that on macOS you might need to install the OpenSSL (https://www.openssl.org/) command-line application. To do that, if you don't already have it, install homebrew (https://brew.sh/), which will allow you to install OpenSSL.

```
/bin/bash -c "$(curl -fsSL https://raw.githubusercontent.com/Homebrew/install/HEAD/install.sh)"
brew install openssl
```

The majority of Linux distros come with OpenSSL installed. If not, it can be installed via your default package manager.

Then, we can create a location to store our local certificate files. This is not a requirement, but it makes it easier to find the keys later.

```
mkdir ~/certs
cd ~/certs
```

With that set up, we're ready to generate the private key to become a local CA:

```
openssl genrsa -des3 -out myCA.key 2048
```

OpenSSL will ask for a passphrase, which we recommend not skipping and keeping safe. The passphrase will prevent anyone who gets your private key from generating a root certificate of their own. The output should look like this:

```
Generating RSA private key, 2048 bit long modulus
.....................................................................+++
.....................................+++
e is 65537 (0x10001)
Enter pass phrase for myCA.key:
Verifying - Enter pass phrase for myCA.key:
```

Next, we generate a root certificate:

```
openssl req -x509 -new -nodes -key myCA.key -sha256 -days 1825 -out myCA.pem
```

You will be prompted for the passphrase of the private key you just chose and a bunch of questions. The answers to those questions aren't that important. They show up when looking at the certificate, which you will almost never do. I suggest making the Common Name something that you'll recognize as your root certificate in a list of other certificates. That's really the only thing that matters.

```
Enter pass phrase for myCA.key:
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:US
State or Province Name (full name) [Some-State]: Springfield State
Locality Name (eg, city) []:Springfield
Organization Name (eg, company) [Internet Widgits Pty Ltd]:Hellfish Media
Organizational Unit Name (eg, section) []:7G
Common Name (e.g. server FQDN or YOUR name) []:Hellfish Media
Email Address []:abraham@hellfish.media
```

You should now have two files: myCA.key (your private key) and myCA.pem (your root certificate).

🎉 Congratulations, you're now a CA. Sort of.

Generating the Private Key and Root Certificate on Windows

On Windows, it's also possible to configure your environment to run the `openssl` commands. You just need some additional tools.

If you are running Windows Subsystem for Linux (https://docs.microsoft.com/en-us/windows/wsl/about) (WSL) then it's as if you're running Linux and the commands will work exactly the same. If you're using Windows with something like WampServer or XAMPP you'll need a way to install the OpenSSL command-line utility in Windows. The most straightforward way to do this is to install Git for Windows (https://gitforwindows.org/), which comes bundled with OpenSSL and the Git Bash utility.

Once you open a Git Bash window, you can run the same commands as for macOS or Linux, with one small difference. Due to how some console applications (specifically OpenSSL) work in Git Bash, you need to prefix all `openssl` commands using the `winpty` utility.

So for example, the following command is how to generate the private key to become a local CA in Git Bash:

```
winpty openssl genrsa -des3 -out myCA.key 2048
```

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The other small differences are the file paths in Git Bash. When you open a Git Bash instance, the home directory in the terminal is mapped to your User directory in Windows, but with a Linux-like directory structure. So if your User directory is located at `c:\Users\Hellfish` in Windows, your Git Bash home directory will be `c/Users/Hellfish`.

Installing Your Root Certificate

To become a real CA, you need to get your root certificate on all the devices in the world.

But we don't need to become a real CA. We just need to be a CA for the devices you own. We need to add the root certificate to any laptops, desktops, tablets, and phones that access your HTTPS sites. This can be a bit of a pain, but the good news is that we only have to do it once. Our root certificate will be good until it expires.

Adding the Root Certificate to macOS Monterey Keychain

Via the CLI

```
sudo security add-trusted-cert -d -r trustRoot -k "/Library/Keychains/System.keychain" myCA.pem
```
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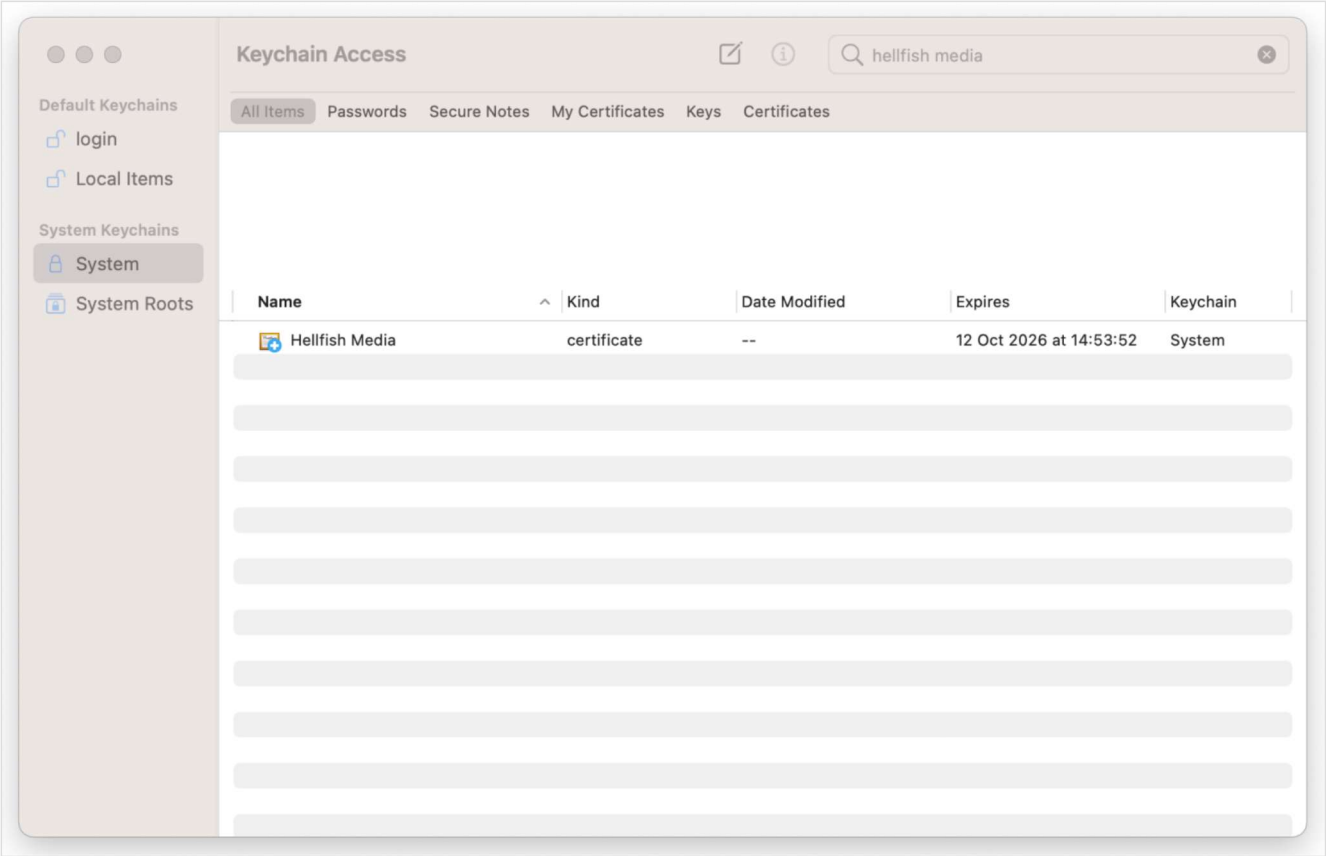
Via the macOS Keychain App

1. Open the macOS Keychain app
2. If required, make sure you've selected the **System Keychain** (older macOS versions default to this keychain)
3. Go to **File > Import Items...**
4. Select your private key file (i.e. `myCA.pem`)

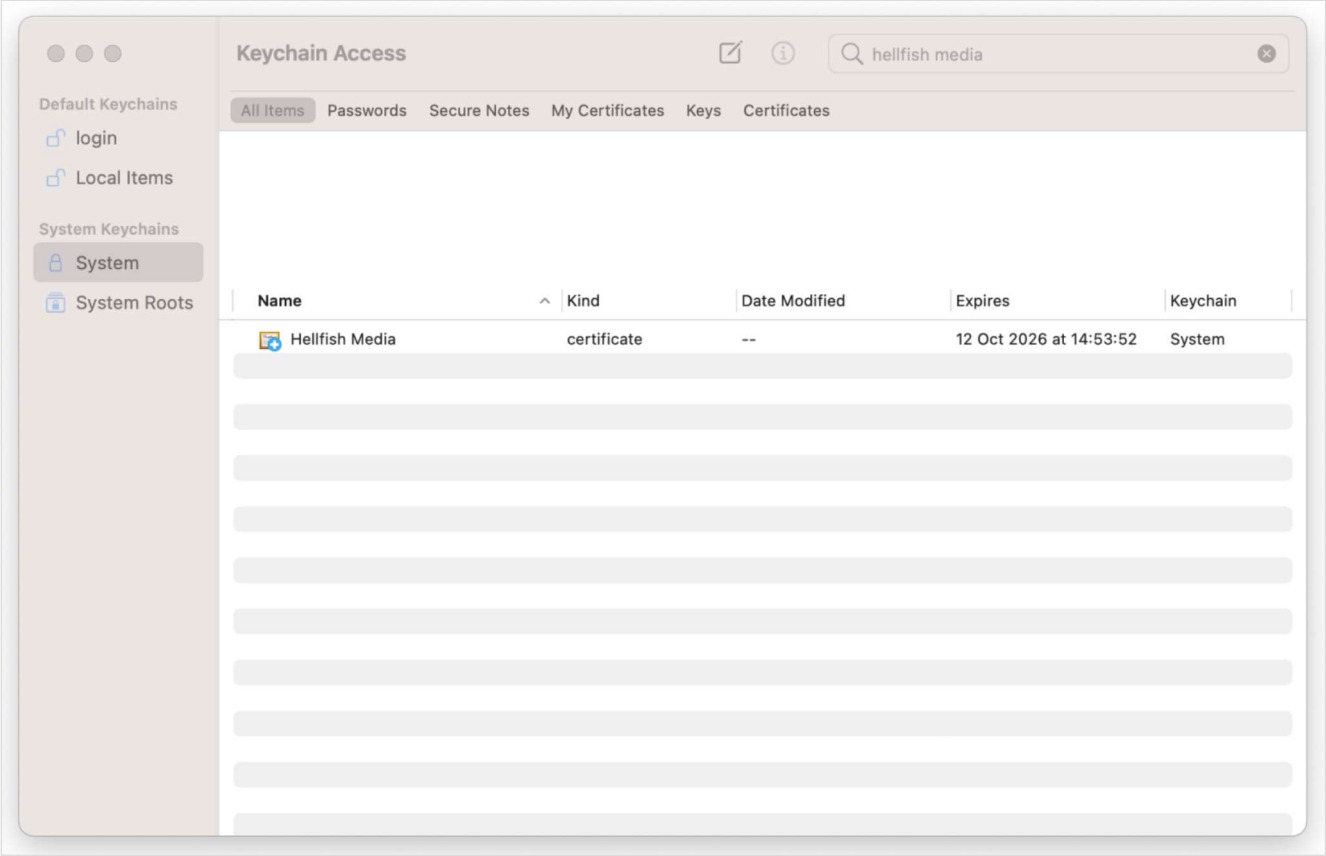
5 Search for whatever you answered as the “Common Name” name above



6 Double-click on your root certificate in the list

7 Expand the **Trust** section

8 Change the “When using this certificate:” select box to **Always Trust**



9. Close the certificate window
10. During the process it may ask you to enter your password (or scan your finger), do that
11. 🎉 Celebrate!

Adding the Root Certificate to Linux

There are so many Linux distributions, but Ubuntu is by far the most popular and it's what we used when we built SpinupWP (https://spinupwp.com/). Therefore these instructions will cover Ubuntu.

1. If it isn't already installed, install the `ca-certificates` package.

   ```
   sudo apt-get install -y ca-certificates
   ```

2. Copy the `myCA.pem` file to the `/usr/local/share/ca-certificates` directory as a `myCA.crt` file.

   ```
   sudo cp ~/certs/myCA.pem /usr/local/share/ca-certificates/myCA.crt
   ```

3. Update the certificate store. `sudo update-ca-certificates`

You can test that the certificate has been installed by running the following command:

```
awk -v cmd='openssl x509 -noout -subject' '/BEGIN/{close(cmd)};{print | cmd}' < /etc/ssl/certs/Copyrti
```

If it's installed correctly, you'll see the details of the root certificate.

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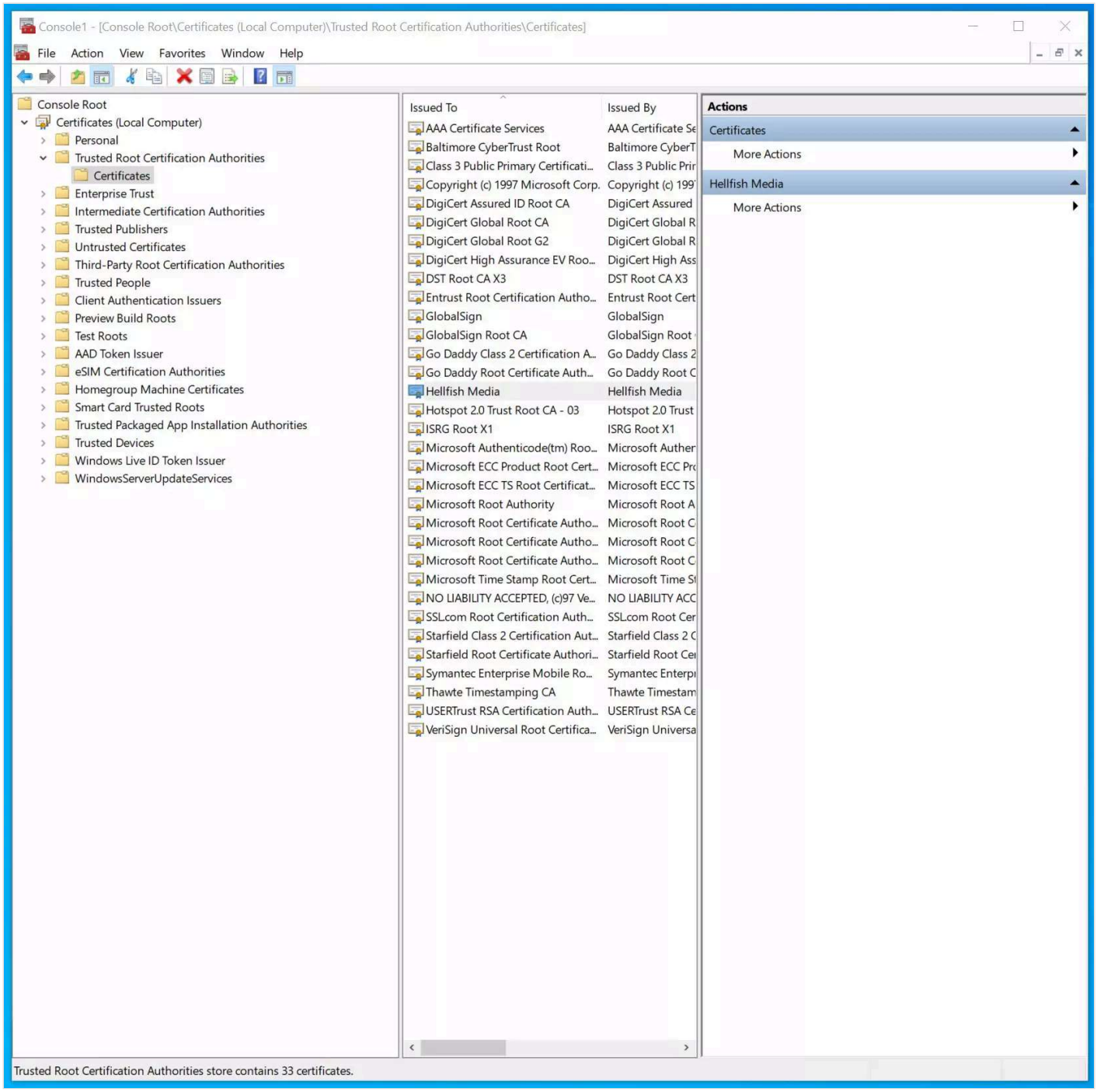
```
subject=C = US, ST = Springfield State, L = Springfield, O = Hellfish Media, OU = 7G, CN = Hellfish Media, em
```

Adding the Root Certificate to Windows 10

1. Open the "Microsoft Management Console" by using the **Windows + R** keyboard combination, typing `mmc` and clicking **Open**
2. Go to **File > Add/Remove Snap-in**
3. Click **Certificates** and **Add**

4. Select **Computer Account** and click **Next**
5. Select **Local Computer** then click **Finish**
6. Click **OK** to go back to the MMC window
7. Double-click **Certificates (local computer)** to expand the view
8. Select **Trusted Root Certification Authorities**, right-click on **Certificates** in the middle column under "Object Type" and select **All Tasks** then **Import**
9. Click **Next** then **Browse**. Change the certificate extension dropdown next to the filename field to **All Files (*.*)** and locate the `myCA.pem` file, click **Open**, then **Next**
10. Select **Place all certificates in the following store**. "Trusted Root Certification Authorities store" is the default. Click **Next** then click **Finish** to complete the wizard.

If everything went according to plan, you should see your CA certificate listed under **Trusted Root Certification Authorities > Certificates**.

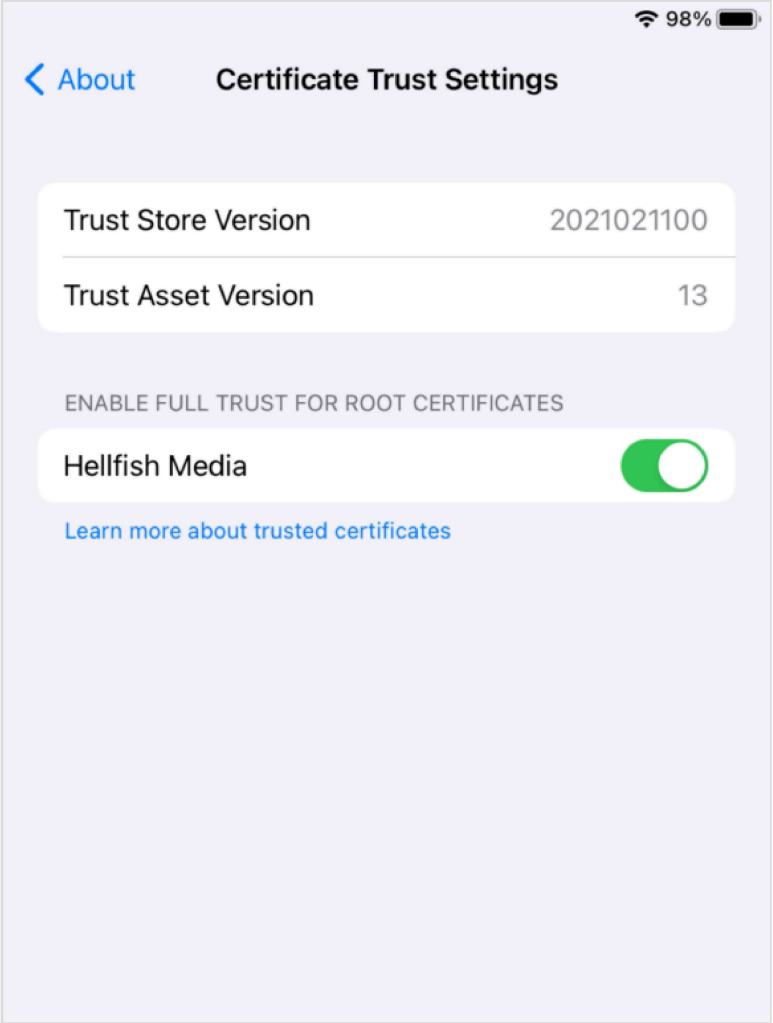


Adding the Root Certificate to iOS 14

If you use something like ngrok (https://ngrok.com/) to browse to your local development sites on mobile devices, you might need to add the root certificate to these devices. On iOS devices you can do so fairly easily by following these steps:

1. Email the root certificate to yourself, so you can access it on your iOS device. Make sure to use the default Mail app to access the email.
2. Tap on the attachment in the email on your iOS device. It will prompt you to review the profile in the Settings app.

3. Open the Settings app and click **Profile Downloaded** near the top.
4. Click **Install** in the top right, and then **Install** again on the Warning screen.
5. Once installed, hit **Close** and go back to the main Settings page.
6. Go to **General > About**.
7. Scroll to the bottom and click on **Certificate Trust Settings**.
8. Enable your root certificate under "ENABLE FULL TRUST FOR ROOT CERTIFICATES".



Creating CA-Signed Certificates for Your Dev Sites

Now we're a CA on all our devices and we can sign certificates for any new dev sites that need HTTPS. First, we create a private key for the dev site. Note that we name the private key using the domain name URL of the dev site. This is not required, but it makes it easier to manage if you have multiple sites:

```
openssl genrsa -out hellfish.test.key 2048
```

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Then we create a CSR:

```
openssl req -new -key hellfish.test.key -out hellfish.test.csr
```

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You'll get all the same questions as you did above and, again, your answers don't matter. In fact, they matter even *less* because you won't be looking at this certificate in a list next to others.

```
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:US
State or Province Name (full name) [Some-State]:Springfield State
Locality Name (eg, city) []:Springfield
Organization Name (eg, company) [Internet Widgits Pty Ltd]:Hellfish Media
Organizational Unit Name (eg, section) []:7G
Common Name (e.g. server FQDN or YOUR name) []:Hellfish Media
Email Address []:asimpson@hellfish.media

Please enter the following 'extra' attributes
to be sent with your certificate request
A challenge password []:
An optional company name []:
```

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Finally, we'll create an X509 V3 certificate extension config (https://www.openssl.org/docs/man1.0.2/man1/x509.html) file, which is used to define the Subject Alternative Name (https://www.digicert.com/faq/subject-alternative-name.htm) (SAN) for the certificate. In our case, we'll create a configuration file called `hellfish.test.ext` containing the following text:

```
authorityKeyIdentifier=keyid,issuer
basicConstraints=CA:FALSE
keyUsage = digitalSignature, nonRepudiation, keyEncipherment, dataEncipherment
subjectAltName = @alt_names

[alt_names]
DNS.1 = hellfish.test
```

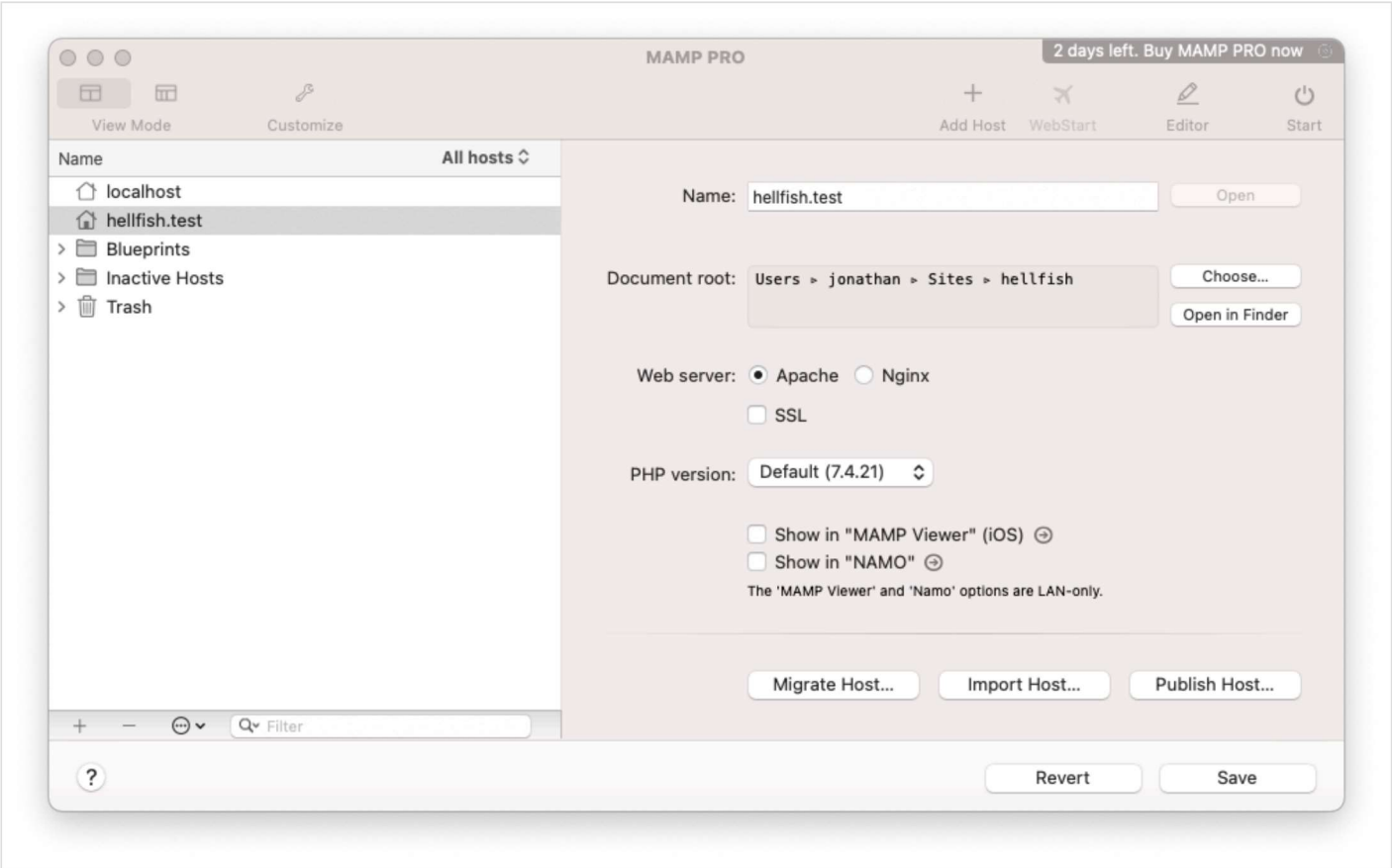
We'll be running `openssl x509` because the x509 command (https://www.openssl.org/docs/man1.0.2/man1/x509.html) allows us to edit certificate trust settings. In this case we're using it to sign the certificate in conjunction with the config file, which allows us to set the Subject Alternative Name. I originally found this answer on Stack Overflow (https://stackoverflow.com/a/43665244).

Now we run the command to create the certificate: using our CSR, the CA private key, the CA certificate, and the config file:

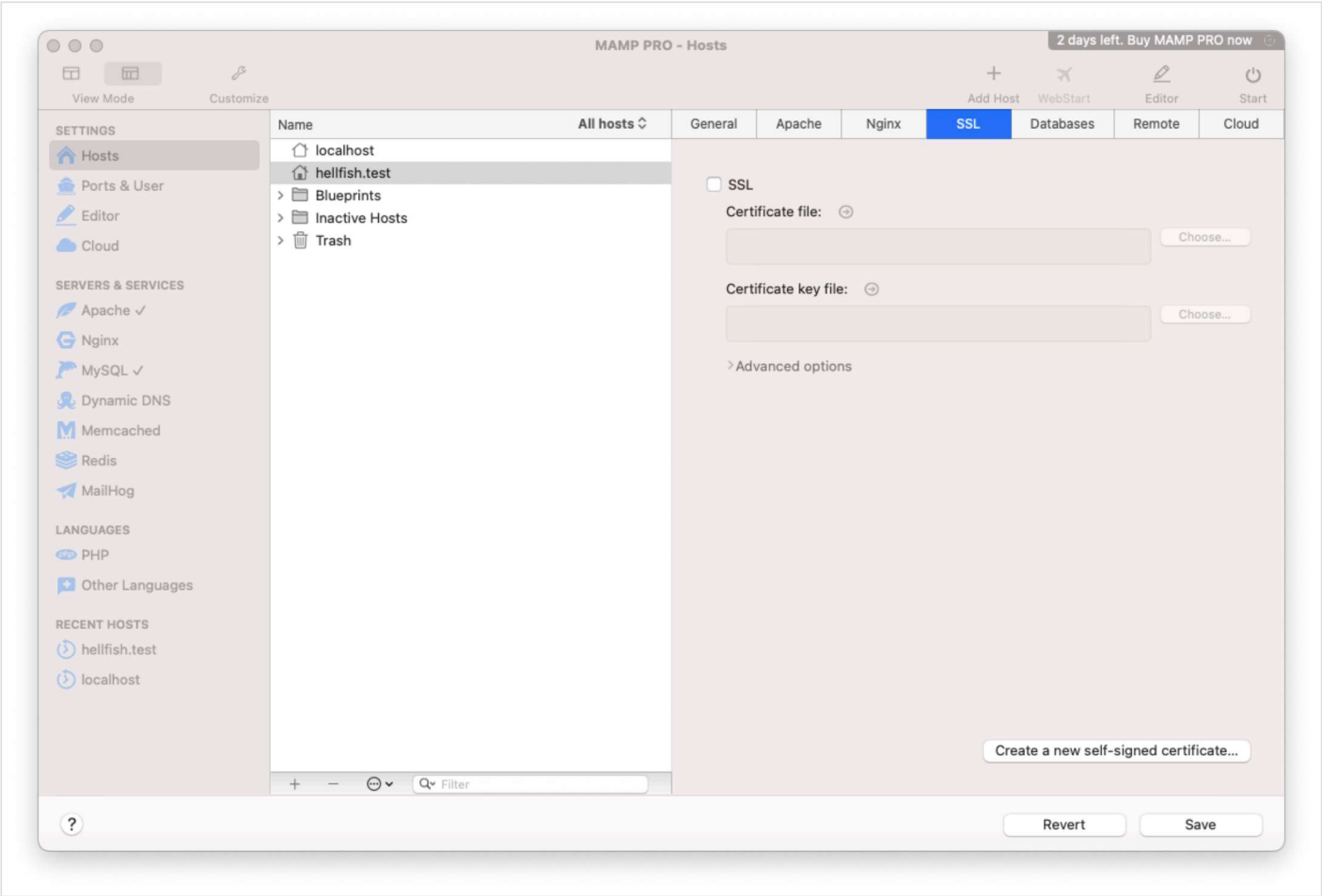
```
openssl x509 -req -in hellfish.test.csr -CA myCA.pem -CAkey myCA.key \
-CAcreateserial -out hellfish.test.crt -days 825 -sha256 -extfile hellfish.test.ext
```

We now have three files: `hellfish.test.key` (the private key), `hellfish.test.csr` (the certificate signing request, or csr file), and `hellfish.test.crt` (the signed certificate). We can configure local web servers to use HTTPS with the private key and the signed certificate.

If you're using MAMP Pro, version 6.0 introduced built-in SSL support. You can enable it by checking the SSL box under your selected web server.



If you prefer to use the locally signed certificate we've just set up, you can do this by enabling the "Expert" view, clicking on the **SSL** tab, and choosing your "Certificate" and "Certificate key" (private key) files.



If you're running a Linux or Windows environment which uses Nginx you can use the instructions in our Install WordPress on Ubuntu 20.04 series (https://spinupwp.com/hosting-wordpress-yourself-setting-up-sites/#obtaining-a-certificate).

If you're on Linux or Windows using Apache, you'll need to enable the Apache SSL mod, and configure an Apache virtual host for port 443 for the local site. It will require you to add the `SSLEngine`, `SSLCertificateFile`, and `SSLCertificateKeyFile` directives, and point the last two to the certificate and key file you just created.

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```
<VirtualHost *:443>
   ServerName hellfish.test
   DocumentRoot /var/www/hellfish-test

   SSLEngine on
   SSLCertificateFile /path/to/certs/hellfish.test.crt
   SSLCertificateKeyFile /path/to/certs/hellfish.test.key
</VirtualHost>
```

We don't have instructions for how to do this on Windows using IIS, because WordPress is not the easiest to configure on IIS systems.

We don't have to create a new CA for each site. We can just repeat this last part of creating a certificate for any other dev sites.

Shell Script

To make things even speedier, here's a handy shell script you can modify for your own purposes. It should work on macOS, Linux, or Windows via Git Bash:

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```
#!/bin/sh

if [ "$#" -ne 1 ]
then
  echo "Usage: Must supply a domain"
  exit 1
fi

DOMAIN=$1

cd ~/certs

openssl genrsa -out $DOMAIN.key 2048
openssl req -new -key $DOMAIN.key -out $DOMAIN.csr

cat > $DOMAIN.ext << EOF
authorityKeyIdentifier=keyid,issuer
basicConstraints=CA:FALSE
keyUsage = digitalSignature, nonRepudiation, keyEncipherment, dataEncipherment
subjectAltName = @alt_names
[alt_names]
DNS.1 = $DOMAIN
EOF

openssl x509 -req -in $DOMAIN.csr -CA ../myCA.pem -CAkey ../myCA.key -CAcreateserial \
-out $DOMAIN.crt -days 825 -sha256 -extfile $DOMAIN.ext
```