This document describes how you can set up an Nginx Load Balancer for FirstClass Web Services. Nginx will be running on a Macintosh, but the instances of fcws can either be running on the same machine, or on another Mac OR Linux box.

For the purposes of this document, I will demonstrate both Nginx and 3 instances of FCWS running under CherryPy all on the same box.

Why Load Balance?

Load balancing is especially important for networks where it's difficult to predict the number of requests that will be issued to a server. Such is the case with FirstClass Web Services. If you find that responses are slow, you may find that you have reached a threshold on the CherryPy instance that is running FirstClass Web Services. Each user uses at least 2 threads so if you have a higher concurrency, you should consider installing a load balancer in front of multiple instances of FCWS, each set to provide 200 threads. This will mean that the load will be distributed across each of the instances and each instance can handle 100 users.

There are many different types of load balancers, including Apache and F5, but Nginx is the one that we are going to install.

The free version of Nginx that we will install and compile has the advantage of supporting Web Sockets, wereas Apache does not.

Multiple Instances of FCWS

You can have multiple instances of fcws running under CherryPy on the same Mac or Linux box. In this section we will learn how to modify the startup script to initialize three instances running on ports 8000, 8001 and 8002.

The startfcws.command or startfcws.sh startup script

The initial startup script for fcws is located in the FirstClass Web Services folder and has a default that looks something like this:

Macintosh

```
sudo /System/Library/Frameworks/Python.framework/Versions/2.7/Resources/Python.app/
Contents/MacOS/Python "/Library/FirstClass Web Services/fcws-12.1.0.025N-osx/fcws/cherry.
pyc" -H 0.0.0.0 -p 80 -e True
```

Linux

```
sudo /usr/bin/python2.6 "/opt/FirstClass Web Services/fcws-12.1.0.025N-linux/fcws/cherry.
pyc" -H 0.0.0.0 -p 80 -e True
```

The fcws version number will change with each upgrade. The above example is showing fcws 12.1 build 25.

Modify the startsfcws script to start 3 different instances

We are going to modify the start script to listen on 3 different **http** ports. We will **not** be listening on https as we will let Nginx do that. We can place our fcws servers behind a firewall and not allow access to the http ports except from the nginx box itself.

To create 3 instances of fcws to listen for http only on 3 different ports, we can modify the startup script as follows:

Macintosh

```
sudo /System/Library/Frameworks/Python.framework/Versions/2.7/Resources/Python.app/
Contents/MacOS/Python "/Library/FirstClass Web Services/fcws-12.1.0.025N-osx/fcws/cherry.
pyc" -H 0.0.0.0 -p 8001 --httpthreads=200 &
/System/Library/Frameworks/Python.framework/Versions/2.7/Resources/Python.app/Contents/
MacOS/Python "/Library/FirstClass Web Services/fcws-12.1.0.025N-osx/fcws/cherry.pyc" -H 0.
0.0.0 -p 8002 --httpthreads=200 &
/System/Library/Frameworks/Python.framework/Versions/2.7/Resources/Python.app/Contents/
MacOS/Python "/Library/FirstClass Web Services/fcws-12.1.0.025N-osx/fcws/cherry.pyc" -H 0.
0.0.0 -p 8003 --httpthreads=200
```

Linux

```
sudo /usr/bin/python2.6 "/opt/FirstClass Web Services/fcws-12.1.0.025N-linux/fcws/cherry.
pyc" -H 0.0.0.0 -p 8001 --httpthreads=200 &
/usr/bin/python2.6 "/opt/FirstClass Web Services/fcws-12.1.0.025N-linux/fcws/cherry.pyc" -
```

```
H 0.0.0.0 -p 8002 --httpthreads=200 &
/usr/bin/python2.6 "/opt/FirstClass Web Services/fcws-12.1.0.025N-linux/fcws/cherry.pyc" -
H 0.0.0.0 -p 8003 --httpthreads=200
```

Notice that in both cases, i have done the following:

- removed the -e True switch as we will not be enabling https here
- set the ports to 8001, 8002 and 8003 and
- set each instance to have 200 http threads.

After starting fcws, the console will display something that looks like this, indicating that all three instances are running.

```
Mon Jul 13 10:12:05 2015 127.0.0.1 [system]WARNING: HTML sanitizer disabled. Python LXML-CLEANER package not found.
Mon Jul 13 10:12:05 2015 127.0.0.1 [system]WARNING: HTML sanitizer disabled. Python LXML-CLEANER package not found.
Mon Jul 13 10:12:05 2015 127.0.0.1 [system]WARNING: HTML sanitizer disabled. Python LXML-CLEANER package not found.
Mon Jul 13 10:12:05 2015 127.0.0.1 [system]Configuring CherryPy Server for hosting OpenText FC WebServer 12.1.0.025 (FC WebAPI 1) (Darwin).
Mon Jul 13 10:12:05 2015 127.0.0.1 [system]Configuring CherryPy Server for hosting OpenText FC WebServer 12.1.0.025 (FC WebAPI 1) (Darwin).
Mon Jul 13 10:12:05 2015 127.0.0.1 [system]ERROR: CherryPy WSGI Server - SSL Key file (key.pem) could not be found. SSL server will not be configured.
Mon Jul 13 10:12:05 2015 127.0.0.1 [system]ERROR: CherryPy WSGI Server - SSL Key file (key.pem) could not be found. SSL server will not be configured.
Mon Jul 13 10:12:05 2015 127.0.0.1 [system]CherryPy WSGI Server - Configuring 0.0.0.0 on HTTP port 8003, running 200 threads.
Mon Jul 13 10:12:05 2015 127.0.0.1 [system]CherryPy WSGI Server - Configuring 0.0.0.0 on HTTP port 8002, running 200 threads.
[13/Jul/2015:10:12:05] ENGINE Bus STARTING
[13/Jul/2015:10:12:05] ENGINE Bus STARTING
[13/Jul/2015:10:12:05] ENGINE Started monitor thread '_TimeoutMonitor'.
[13/Jul/2015:10:12:05] ENGINE Started monitor thread '_TimeoutMonitor'.
Mon Jul 13 10:12:05 2015 127.0.0.1 [system]Configuring CherryPy Server for hosting OpenText FC WebServer 12.1.0.025 (FC WebAPI 1) (Darwin).
Mon Jul 13 10:12:05 2015 127.0.0.1 [system]ERROR: CherryPy WSGI Server - SSL Key file (key.pem) could not be found. SSL server will not be configured.
Mon Jul 13 10:12:05 2015 127.0.0.1 [system]CherryPy WSGI Server - Configuring 0.0.0.0 on HTTP port 8001, running 200 threads.
[13/Jul/2015:10:12:05] ENGINE Bus STARTING
[13/Jul/2015:10:12:05] ENGINE Started monitor thread '_TimeoutMonitor'.
[13/Jul/2015:10:12:05] ENGINE Serving on 0.0.0.0:8002
[13/Jul/2015:10:12:05] ENGINE Bus STARTED
[13/Jul/2015:10:12:05] ENGINE Serving on 0.0.0.0:8003
[13/Jul/2015:10:12:05] ENGINE Bus STARTED
[13/Jul/2015:10:12:05] ENGINE Serving on 0.0.0.0:8001
[13/Jul/2015:10:12:05] ENGINE Bus STARTED
/usr/sbin/fcwsctl start: FirstClass Web Services (cherry.py) started ( 7827 7826 7825 7824 ).
```

Nginx for Mac

Nginx is a free, open-source, high-performance HTTP server and reverse proxy, as well as an IMAP/POP3 proxy server. Nginx is known for its high performance, stability, rich feature set, simple configuration, and low resource consumption.

Nginx powers several high-visibility sites, such as Netflix, Hulu, Pinterest, CloudFlare, Airbnb, WordPress.com, GitHub, SoundCloud, Zynga, Eventbrite, Zappos, Media Temple, Heroku, RightScale, Engine Yard and MaxCDN

In this document, I will be installing Nginx for Macintosh using a modified script provided by Kevin Worthington http://kevinworthington.com/nginx-for-mac-os-x-mavericks-in-2-minutes/ The script compiles a basic version of Nginx 1.5.7.

The script accompanies this tutorial.

The script has been tested on OS X Mavericks (10.9) and this version of the Mac OS is recommended.

Xcode is required

In order to run the script and have it compile nginx, you must have Xcode installed.

You can get Xcode for free from the Mac App store. Xcode 6 requires OS X 10.9.**5** or later.

For earlier versions of Mavericks, you can download and install Xcode v5.1 from http://adcdownload.apple.com/Developer_Tools/xcode_5.1.1/xcode_5.1.1.dmg but you will have to join the Apple Developer program.

Installing Nginx

Once you have Xcode installed, you can use the provided script to download and compile Nginx.

To utilize the script you must use terminal to navigate to the folder where you have downloaded the shell script named **build-nginx-mac-osx-mavericks.sh**

Before you can execute the script, you first have to change the permissions. With terminal open and in the same directory as the script, type in the following command.

```
chmod a+x build-nginx-mac-osx-mavericks.sh
```

Now you can execute the script using the command

```
./build-nginx-mac-osx-mavericks.sh
```

You will be asked for the SUDO password and once entered, Nginx will be downloaded and compiled.

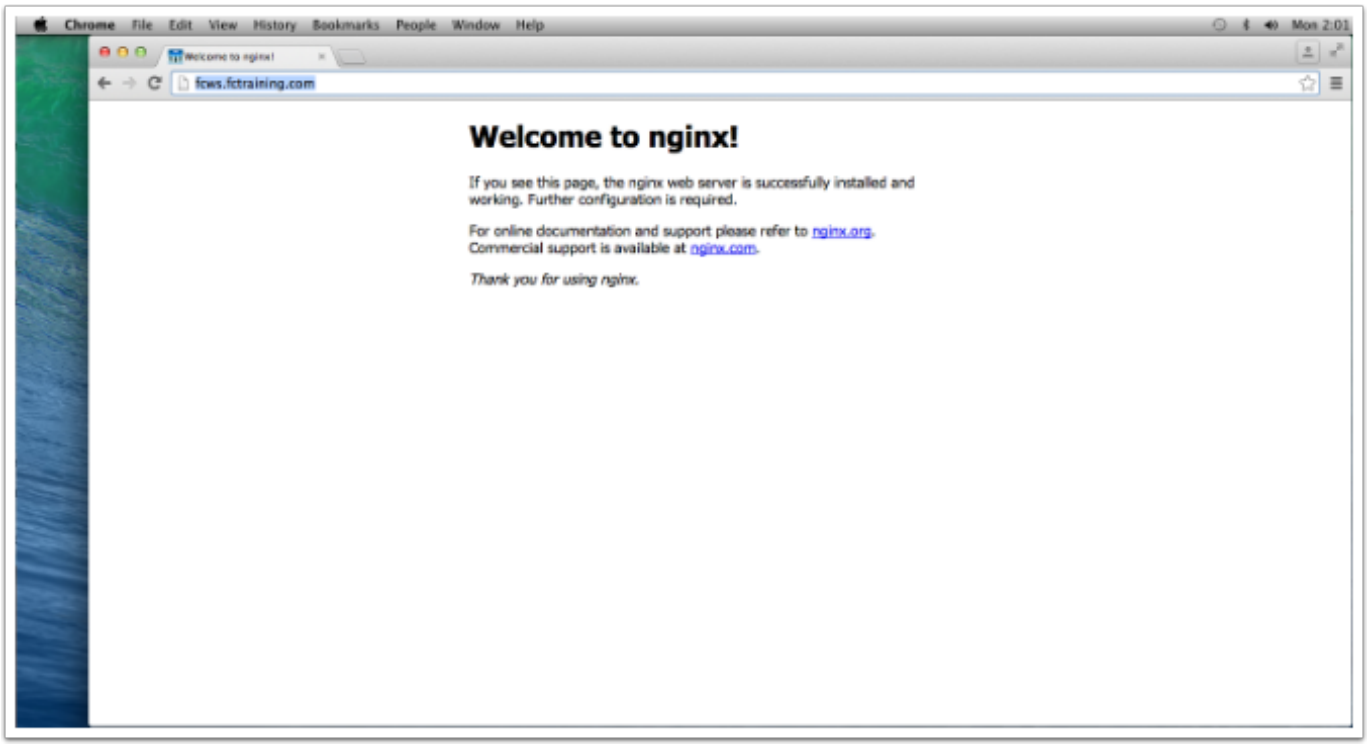
Testing the Install

If all goes well, Nginx will have been installed and started.

You can test your server by visiting your server by either using localhost on the server where you have installed Nginx or, use the domain name that you have established for the IP where you have installed Nginx.

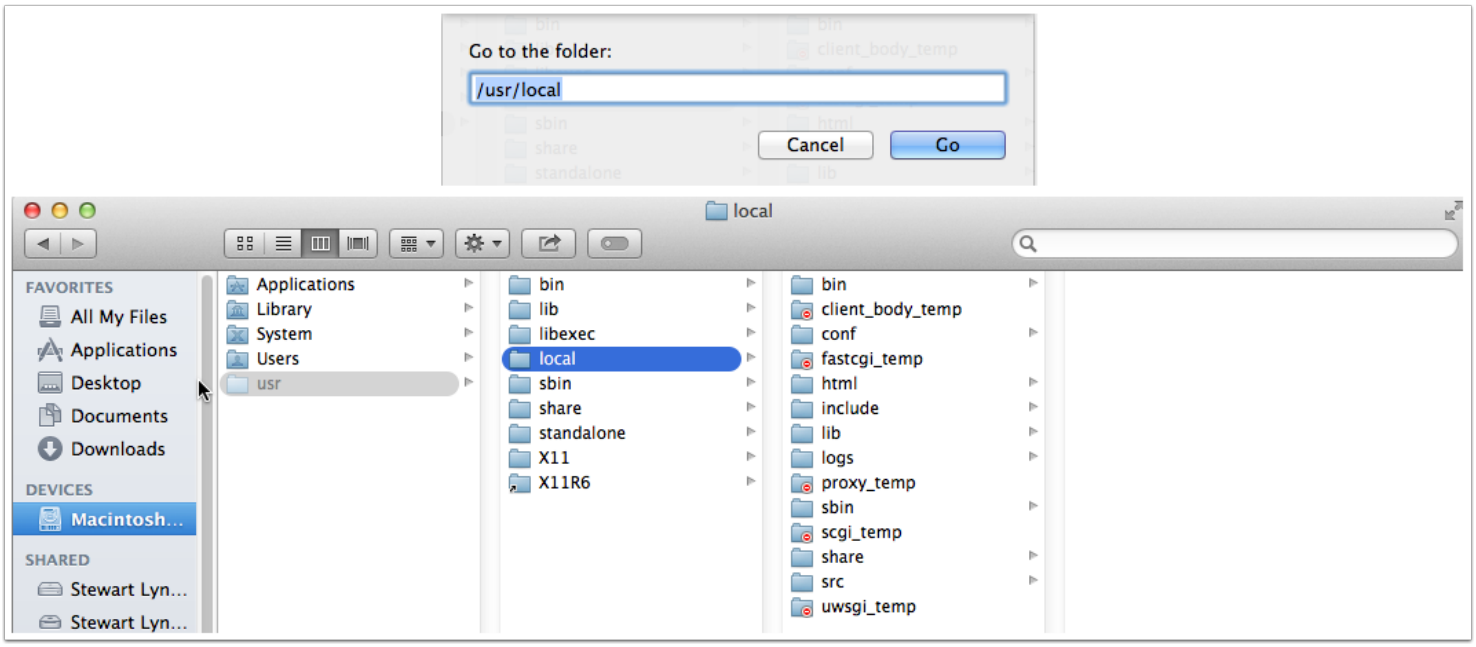
In my case, Nginx is installed at fcws.fctraining.com

If you visit your site and see the following page, you know you have a successful installation



Nginx Directories

Nginx has been installed in the /usr/local directory, but since the usr directory is hidden by default, you can use the Finder's Go>Go to Folder.... menu to navigate to the folder.



Starting and stopping Nginx

We will have to stop Nginx and change the configuration file to make it a load balancer. You can use Terminal to stop it but you will have to use the full path in your command. The nginx executable is stored in the /usr/local/sbin folder so to stop the currently running nginx, type in the following in terminal:

```
sudo /usr/local/sbin/nginx -s stop
```

Update your environment variables

To make it easier to start and stop nginx in the future, you might want to consider adding the path to nginx to your environment variables. The easiest way to do this is to edit /etc/paths.

You can do this using the VI editor. In terminal, type

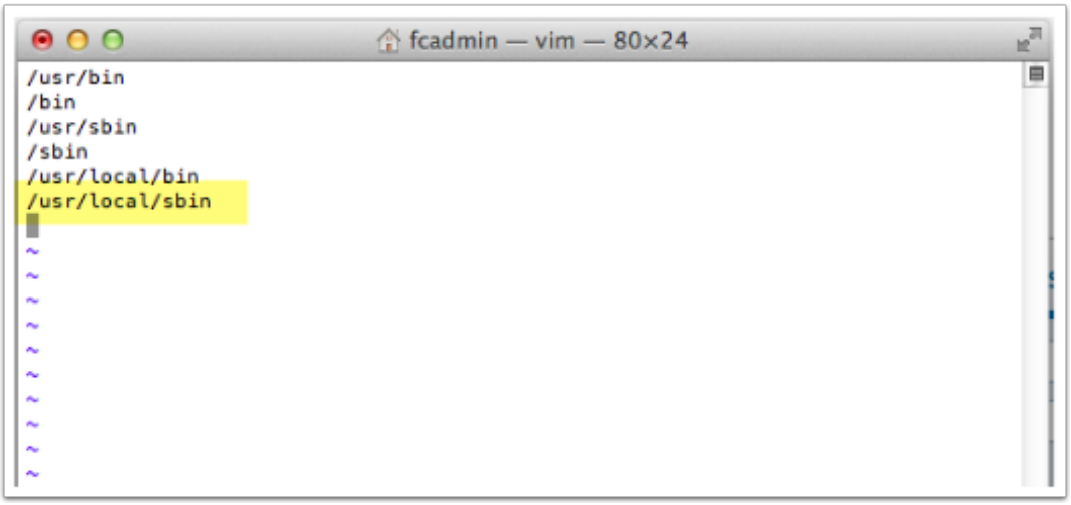
```
sudo vi /etc/paths
```

Use your keyboard to move the cursor down to the end of the last line then press **I** to get in to insert mode. Press **<return>** to move to the next line then enter the following.

```
/usr/local/sbin
```

Then press **<esc>** to exit insert mode. Now type **:wq** to write to the file and quit vi.

You can now quit and reopen terminal and the new path to nginx will be recognized. From now on, to stop nginx, just type **sudo nginx -s stop**



Updating the configuration file

I have provided you with a configuration file called **nginx.conf** that you can use to replace the one that is located in the **/usr/local/conf** folder. Rename the current file in that folder and copy the replacement one to that location.

Open the file in a text editor and confirm the following:

1. In the upstream fcwsInstances section, ensure that the server IP addresses and ports for your fcws instances are correct. In the case shown in the default, all three instances of fcws are running on the same box (127.0.0.1) but they could be running on a linux box somewhere else behind the firewall. The three ports are the ones that we configured (8001,8002 and 8003)

```
upstream fcwsInstances{
    # Use IP hash for sticky session
    ip_hash;
    server 127.0.0.1:8001;
    server 127.0.0.1:8002;
    server 127.0.0.1:8003;
}
```

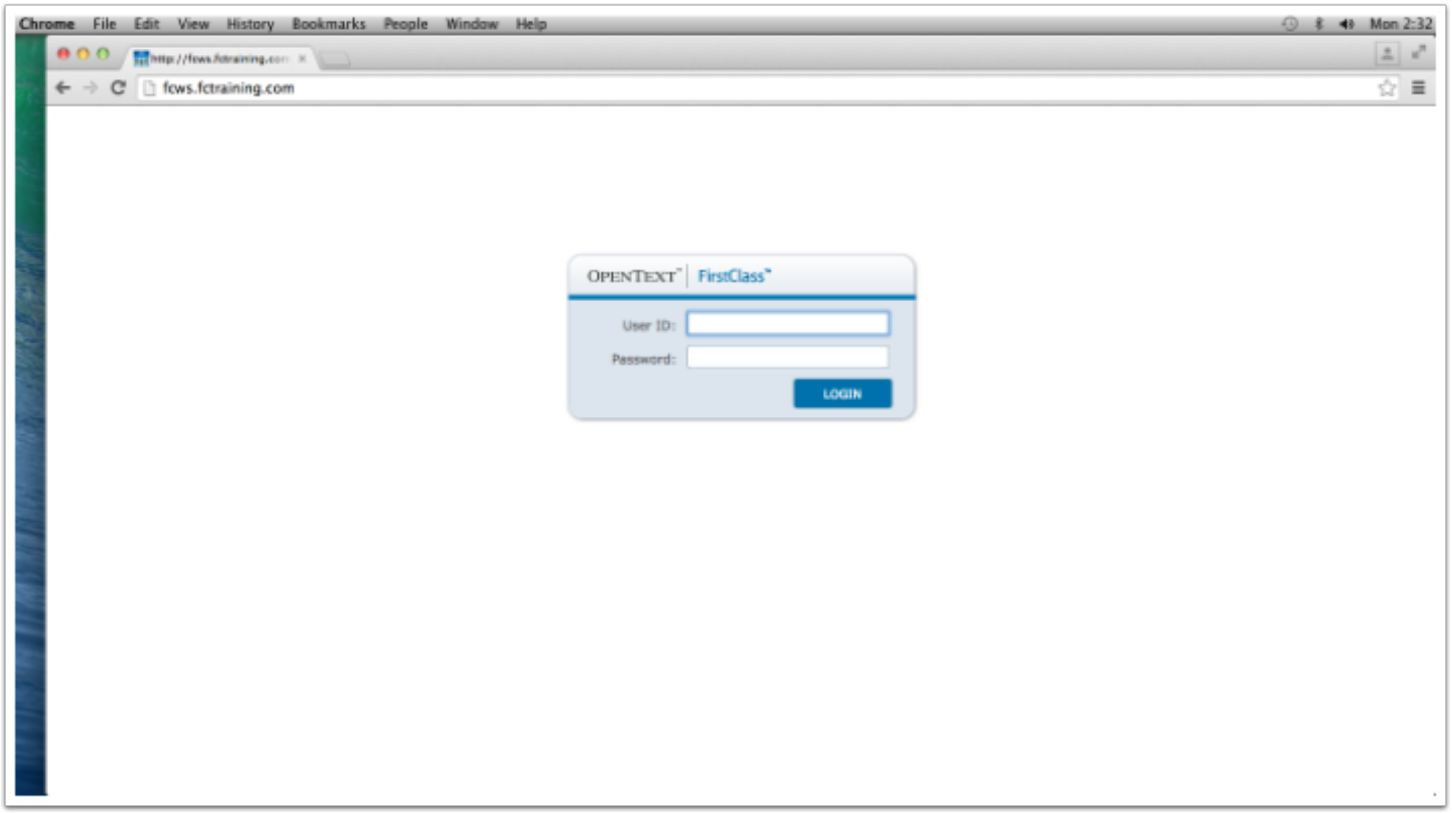
Start fcws and Nginx and test

If they are not already running, start your instances of fcws.

Start nginx using the command (assuming you have updated your environment path.

```
sudo nginx
```

If there are no errors, you should now be able to visit your nginx page and it will be directed to one of your fcws instances.



Installing SSL certificates

If you want to install ssl certificates, you can do this for nginx and modify the configuration file. But first, you will have to stop fcws and modify one of the parameters in the fcws.cfg file to disable the requirement for SSL certificates to be installed on fcws. The assumption here is that we will enable only

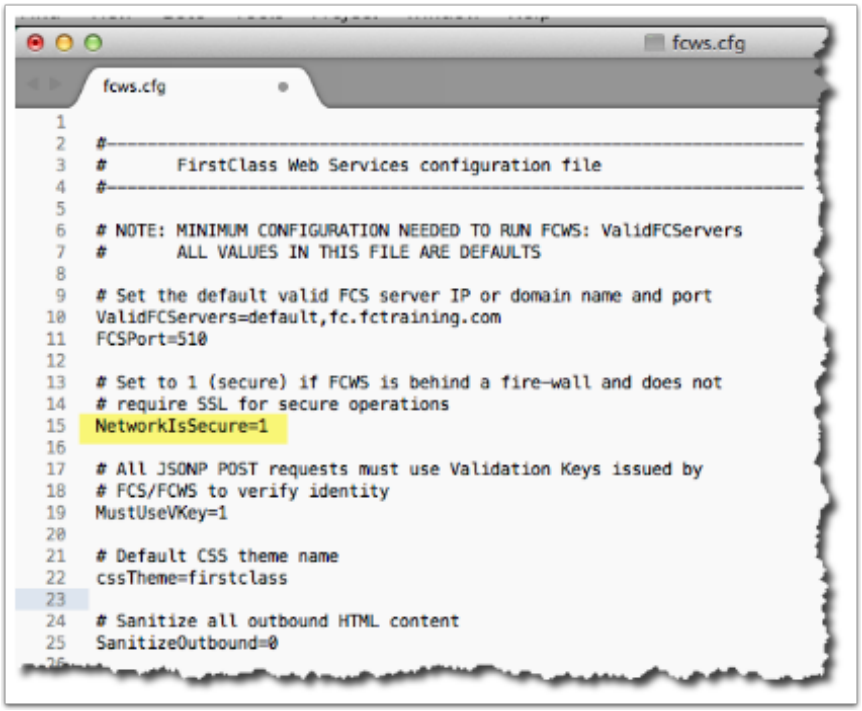
port 443 on the firewall to access the Nginx server and the three ports for fcws will only be accessible by the Nginx proxy behind the firewall and not accessible to the outside.

Modify fcws.cfg

Make sure you stop both fcws and Nginx and navigate to the fcws folder for your operating system.

Open **fcws.cfg** and modify the one line NetworkIsSecure=**0** to read NetworkIsSecure=**1**

Save and close the file and **restart fcws**.



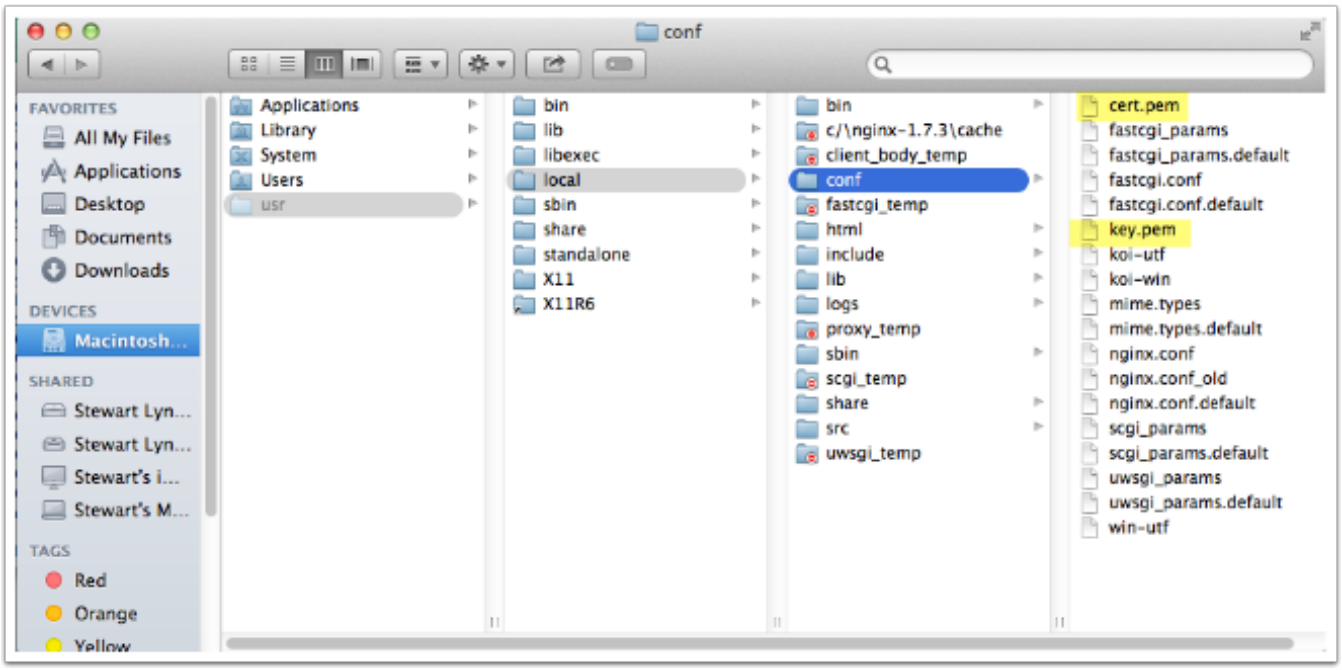
Adding Certificate Files to Nginx

Nginx requires both the private key and certificate files to be installed in the /usr/local/conf folder. These files can be any name, but the names will have to be referenced in the nginx.conf file in the next step. In keeping with the tradition set with a single fcws install, I have called my two files key.pem and cert.pem.

Copy both of these files in to the **/usr/local/conf** folder

NOTE: If your issuing agent supplies you with an intermediate certificate, this will have to be concatenated to the cert.pem file as there is no provision for referencing other certificates in the chain.

You can review this article from Comodo to see how to do this. https://support.comodo.com/index.php?/Default/Knowledgebase/Article/View/789/37/certificate-installation-nginx



Modify the ngnix.conf file

You can now modify the **nginx.conf** file that we have moved into the **/usr/local/conf** folder. Open it in a text editor and in the **server** section:

1. Uncomment lines 24 - 27 by removing the # at the beginning of the line. This will redirect all http traffic on port 80 to port 443, the secure port
2. Comment line 30 by adding a # in front of the line so that it does not listen on port 80 in this section
3. Remove the # from line 31 so that it now listens on port 443
4. Remove the # from lines 32 - 37 to enable the certificates
5. Ensure that your certificate and key file names match yours

Save the file

Test

Restart nginx using the following command in Terminal

```
sudo nginx
```

Point your browser to the insecure port (in my case http://fcws.fctraining.com) and test that it redirects to **https** and recognizes the SSL certificate.