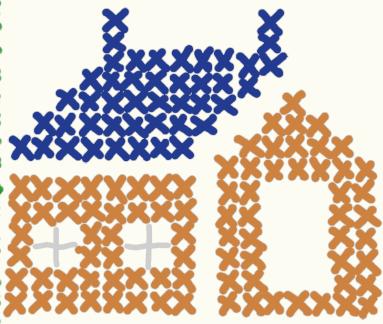


HOST A WEBSITE AT HOME



- install Ubuntu Server
- set up a firewall
- make a web page
- install & configure Apache HTTP Server
- set up port forwarding
- set up DDNS



404 S. 20th St., PHL
iffybooks.net



To the Model Internet Club

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Why host a website at home?

- You control what you post.
- You can definitively take down your website by unplugging it.
- Commercial hosting starts around \$5 per month, so hosting at home may(?) be cheaper in the long run.
- Learning about networking is fun, and useful for future projects.

In this project you'll learn to set up an Ubuntu-based web server on a single-board computer, using Apache HTTP Server to serve your website. You'll configure Apache the proper way, letting you host multiple websites on the same machine if you wish. Then you'll set up a firewall and turn on port forwarding on your home router, exposing your web server to the open web. You'll finish by configuring Dynamic DNS (DDNS) with a domain or subdomain, so your website will remain accessible even when your home IP address changes.

The examples in this zine use the **Orange Pi Zero 2W (OPZ2W)**, an inexpensive single-board computer that uses very little power. You can buy an OPZ2W with 1 GB of RAM for around \$20, but you'll need some additional hardware to get up and running.

We sell complete home web server kits at Iffy Books. The kit costs \$49 as of May 2024, and includes the following:

- Orange Pi Zero 2W single-board computer w/1 GB of RAM
- 32 GB microSD card
- microSD card reader
- 2 Amp USB power supply
- USB-C power cable
- Mini HDMI to HDMI adapter
- USB-C to 2x USB-A adapter

- USB-A to Ethernet adapter
- Ethernet cable

You'll also need the following:

- A monitor (or TV) with HDMI video input
- An HDMI cable
- A keyboard with a USB cable

Choose a domain

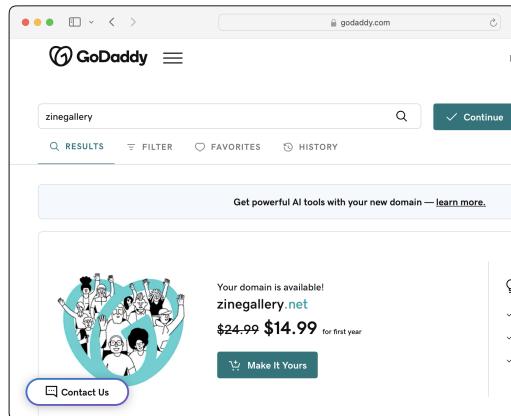
Option 1: If you have a domain already, choose a subdomain

- If you've already registered a domain and you'd like to create a subdomain for this project, the only thing you need to do at this point is decide what subdomain to use. For the examples below we'll use the subdomain **zinegallery.iffybooks.net**. We'll update your domain records later in the project.

Each subdomain string can be up to 63 characters long, case insensitive.

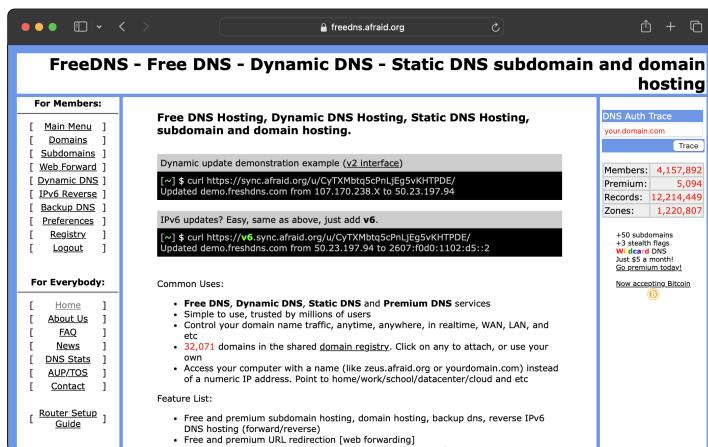
Option 2: Buy a domain

- Go to a domain registry website of your choice, choose a domain name, and enter your credit card info to pay.



Option 3: Sign up for a free subdomain from a DDNS provider

- Go to **freedns.afraid.org** and set up a free subdomain. (There are many other sites that offer free subdomains, including dynv6.com.)



Flash Ubuntu to your SD card

- ❑ Next you'll download the **Ubuntu Server** operating system image for your device. If you're using an Orange Pi Zero 2W, go to the following URL:

<http://www.orangepi.org/html/hardWare/computerAndMicrocontrollers/service-and-support/Orange-Pi-Zero-2W.html>

Here's a QR code for the URL above, in case you're using the printed version of this zine and you don't want to type it out:



- ❑ Under **Ubuntu Image**, click **Downloads**.



That link will take you to a directory on Google Drive. (The folks at Orange Pi are using Google Drive to avoid paying for bandwidth.)

- ❑ Double click on the directory **Linux6.1 kernel version image** to open it.

Name	Owner	Last modified
Linux5.4 kernel version image	zhaoyifan.steven.xl	Sep 17, 2023 zhaoyifan.stev...
Linux6.1 kernel version image	zhaoyifan.steven.xl	Sep 17, 2023 zhaoyifan.stev...

- ❑ Double click on the directory **For development boards with 1GB_2GB memory...** to open it.

Name	Owner	Last modified
For development boards with 1.5GB memory, pl...	zhaoyifan.steven.xl	Sep 17, 2023 zhaoyifan.stev...
For development boards with 1GB_2GB memor...	zhaoyifan.steven.xl	Sep 17, 2023 zhaoyifan.stev...
For development boards with 4GB memory, ple...	zhaoyifan.steven.xl	Sep 17, 2023 zhaoyifan.stev...

- ❑ Right click the file with **server** in the filename and select **Download** to download the compressed disk image file.

Name	Owner	Last modified
Orangepizero2w_1.0.0_ubuntu_jammy_desktop_xfce_linux6.1.31.7z	zhaoyifan.steven.xl	Sep 20, 2023 zha...
Orangepizero2w_1.0.0_ubuntu_jammy_server_linux6.1.31.7z	zhaoyifan.steven.xl	Sep 20, 2023 zha...

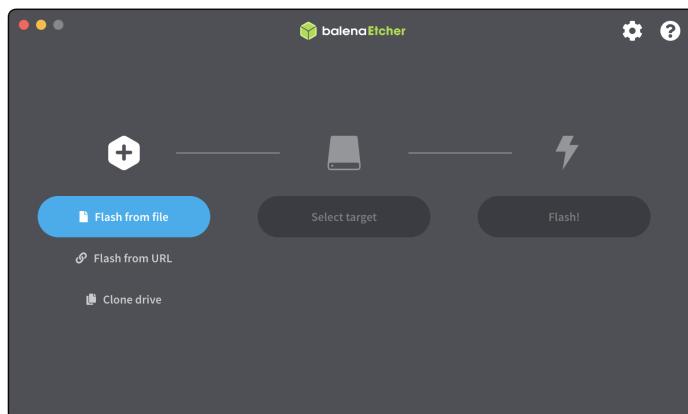
- Open with
- Download
- Rename
- Make a copy

- ❑ Find the file you just downloaded, **Orangepizero2w_1.0.0_ubuntu_jammy_server_linux6.1.31.7z**, in your File Explorer/Finder. Double click the file to extract its contents.

- ❑ You'll end up with a directory containing a disk image file ending with `.img`, along with a `.sha` checksum file.



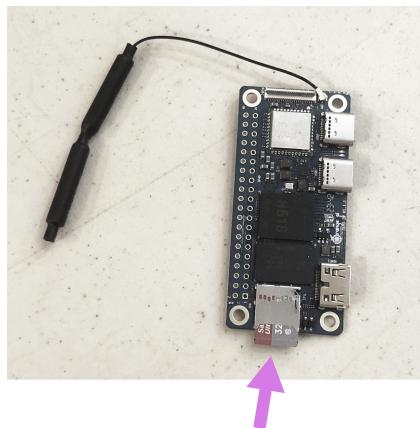
- ❑ Now go to etcher.balena.io and download **balenaEtcher**, which you'll use to flash the Ubuntu image onto your microSD card. balenaEtcher is available for macOS, Windows, and Linux.
- ❑ Insert your microSD card into your microSD card reader and plug it into your computer's USB port. (If your computer only has a USB-C port, use the USB-C to USB-A adapter included in your kit.)
- ❑ Open **balenaEtcher**, click **Flash from file**, and select the `.img` disk image file you just extracted.



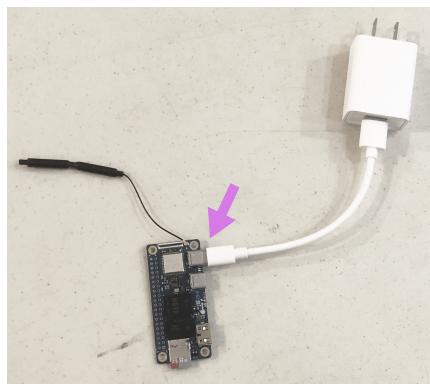
- ❑ In balenaEtcher, click **Select target** and select your microSD card.
- ❑ Click **Flash!** to write the Ubuntu disk image to your microSD card, which will take 5 minutes or so.

Set up your hardware

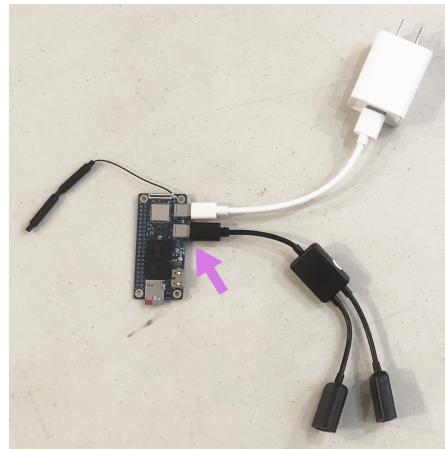
- ❑ Insert the flashed microSD card into the card slot on your single-board computer. The printed side of the microSD card should be facing away from the board.



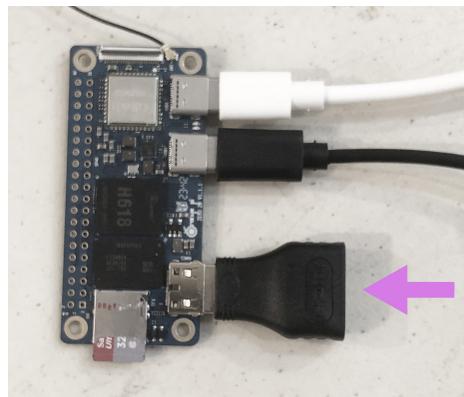
- ❑ Find the USB-C power cable and connect it to your USB power supply. Plug the other end of the cable into the outer USB-C port, closest to the corner of the board.



- ❑ Plug your USB-C to 2x USB-A adapter into the inner USB-C port, closer to the middle of the board. (Note: You can power your computer using either USB-C port, but only the inner port works for connecting USB hardware such as a keyboard.)



- ❑ Connect a USB keyboard to the USB-C to 2x USB-A adapter.
- ❑ Find the Mini HDMI port on your computer and plug in the Mini HDMI to HDMI adapter.



- ❑ Connect an HDMI cable to the Mini HDMI to HDMI adapter. Plug the other end into the HDMI port on your monitor or TV.



Turn on your computer

- ❑ Set up your single-board computer, keyboard, and monitor somewhere close to your home router.
 - ❑ Plug your computer's USB power supply into a wall outlet.
 - ❑ After a brief startup sequence, your screen will look like this:

(Note: From this point on we'll invert the colors in screen captures in order to use less toner in the printed zine.)

- ❑ First you'll set a password for the current user. Type `passwd` at the command prompt, then press **enter**.

- ❑ For the current password, type `orangepi` and press **enter**. You won't see any characters appear onscreen as you type. Then choose a new password and enter it. Write down your new password and/or store it in a password manager app.

```
orangepirzero2w login: orangepi (automatic login)

[ANIMATED LOGO]

Welcome to Orange Pi 1.0.0 Jammy with Linux 6.1.31-sun50iu9

System load: 24% Up time: 0 min
Memory usage: 17% of 981M IP:
CPU temp: 54 °C Usage of /: 7% of 29G

[ 0 security updates available, 2 updates total: apt upgrade ]
Last check: 2023-09-07 09:29

[ General system configuration (beta): orangepi-config ]

Last login: Thu Sep 7 09:29:46 UTC 2023 on tty1
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

orangepi@orangepirzero2w:~$ passwd
Changing password for orangepi.
Current password:
New password:
Retype new password:
```

You're currently logged in as a user called `orangepi`. Next you'll switch to the `root` user and change its password.

- Type `su root` and press **enter**. At the prompt, enter the default password `orangepi`.

```
orangepi@orangepirzero2w:~$ su root
```

- Now type `passwd` and press **enter** to set a new password for your `root` account.

```
root@orangepirzero2w:~# passwd  
New password:  
Retype new password: _
```

- When you're done, run the command `su orangepi` to switch back to the user `orangepi`.

```
root@orangepirzero2w:~# su orangepi
```



Increase the onscreen text size (optional)

If the onscreen text is too small to read comfortably, follow the steps below to increase the size. Otherwise you can skip to the next section.

- Run the following command to open the `console-setup` preferences file using the text editor `nano` :

```
sudo nano /etc/default/console-setup
```

```
orangepi@orangezerow:~$ sudo nano /etc/default/console-setup
```

- Use the arrow keys on your keyboard to move the cursor to the line beginning with `FONTSIZE=`. Delete the value `8x16` and replace it with `16x32`.

```
GNU nano 6.2
# CONFIGURATION FILE FOR SETUPCON

# Consult the console-setup(5) manual page.

ACTIVE_CONSOLES="/dev/tty[1-6]"

CHARMAP="UTF-8"

CODESET="guess"
FONTFACE="Fixed"
FONTSIZE="16x32"

VIDEOMODE=

# The following is an example how to use a braille font
# FONT='lat9w-08.psf.gz brl-8x8.psf'
```

- When you're finished, press `ctrl + X` on your keyboard to close the file. At the bottom left of your screen you'll see the prompt "**Save modified buffer?**" Type `y` for "yes," then press **enter**.



- Press **enter** again to confirm the filename.



- Tip:* You can use the command `clear` at any time to clear the screen.

```
orangepi@orangepizero2w:~$ clear
```

- Now run the command `sudo update-initramfs -u` to confirm the new font size.

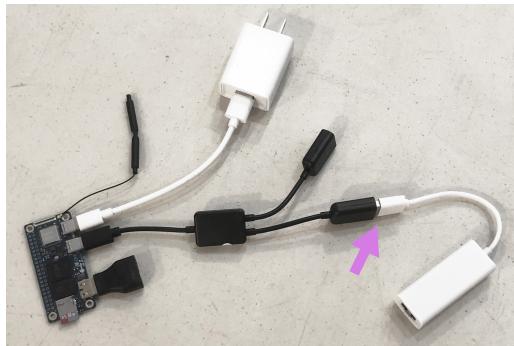
```
orangepi@orangepizero2w:~$ sudo update-initramfs -u
```

- Restart your computer with `sudo reboot`. When your computer finishes rebooting, the onscreen text will be bigger.

Connect to the internet via Ethernet

We strongly recommend connecting your single-board computer to your home router using an Ethernet cable. If you need to use wi-fi temporarily, you can skip to the next section.

- Plug your Ethernet-to-USB adapter into your single-board computer via the USB-C to 2x USB-A adapter.



- Connect an Ethernet cable to the Ethernet-to-USB adapter.
- Connect the other end of the Ethernet cable to an Ethernet port on the back of your home router.
- To confirm you're connected to the internet, you can run the following `ping` command on your single-board computer:

```
ping iffybooks.net
```

If you get output that looks like this, then you're connected to the internet:

```
64 bytes from 104.248.2.93: icmp_seq=1 ttl=54 time=17.613 ms
64 bytes from 104.248.2.93: icmp_seq=2 ttl=54 time=12.127 ms
64 bytes from 104.248.2.93: icmp_seq=3 ttl=54 time=24.315 ms
64 bytes from 104.248.2.93: icmp_seq=4 ttl=54 time=14.224 ms
64 bytes from 104.248.2.93: icmp_seq=5 ttl=54 time=19.906 ms
64 bytes from 104.248.2.93: icmp_seq=6 ttl=54 time=13.988 ms
```

Press **ctrl + C** to close `ping` and return to the command prompt.

Connect to the internet via wi-fi (discouraged! 😬)

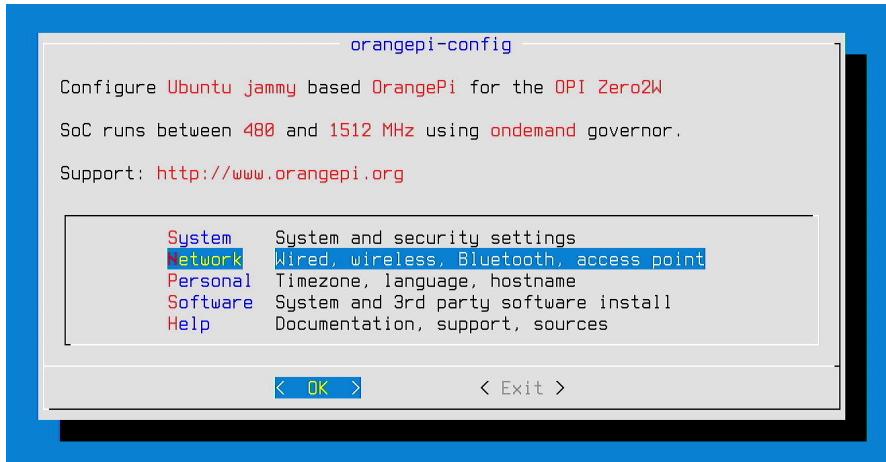
Hosting a website via wi-fi isn't recommended, because maintaining a long-term wireless connection is a headache. If you want to keep using wi-fi temporarily because Ethernet isn't an option, here's how to set it up.

- ❑ Run the command `sudo orangepi-config` to launch the Orange Pi configuration utility.

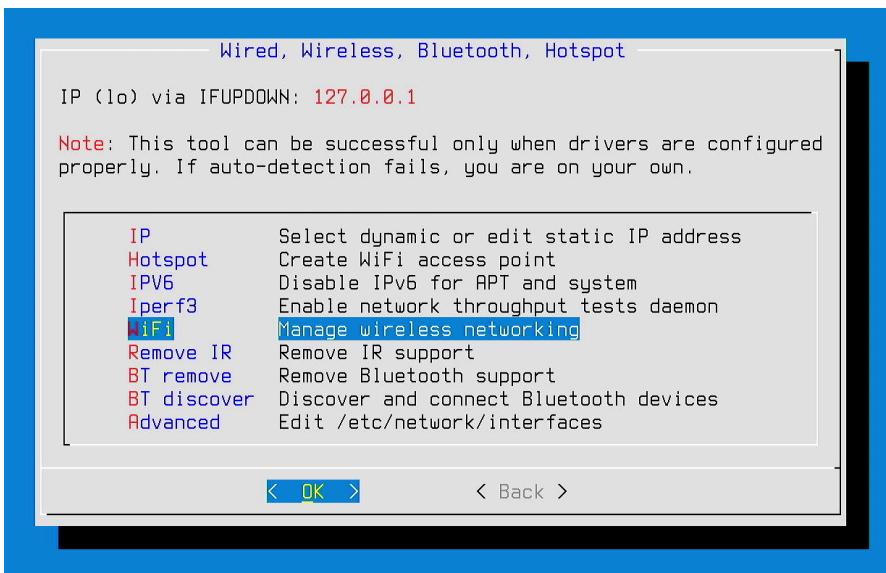
```
orangepi@orangepizero2w:~$ sudo orangepi-config
```

- ❑ You'll see a prompt that reads "**Configuration cannot work properly without a working internet connection.**" Press any key to continue.

- ❑ Use the down arrow key to select the Network menu, then press enter.

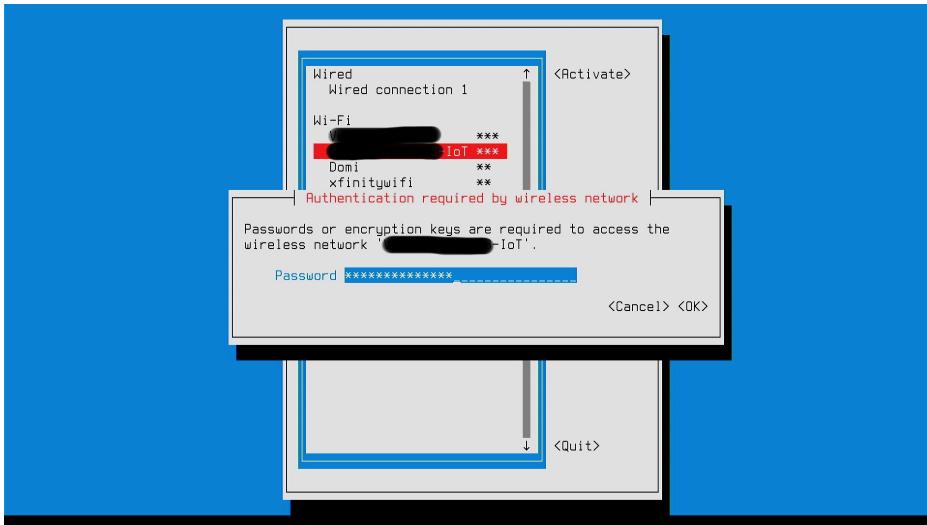


- ❑ Use the down arrow key to select the WiFi menu, then press enter.

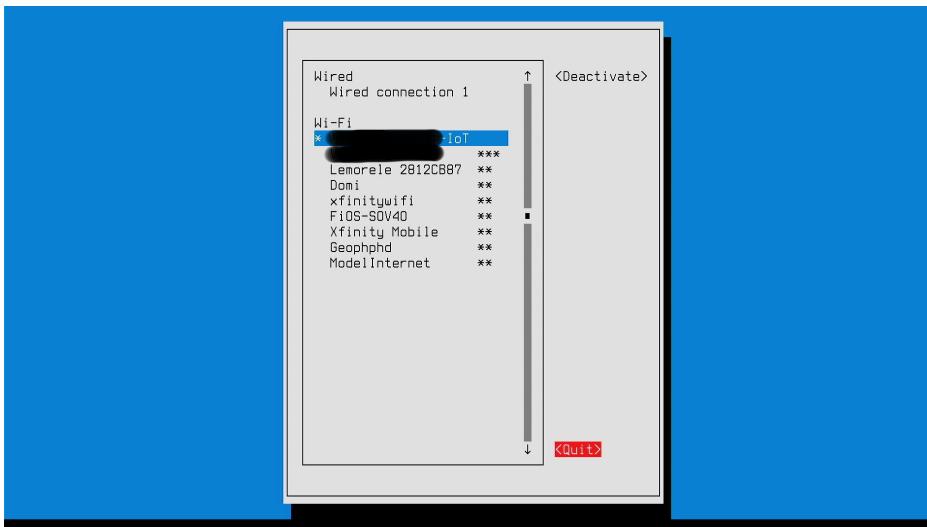


- ❑ You'll see a list of available wi-fi networks. Select your home network, then press enter.

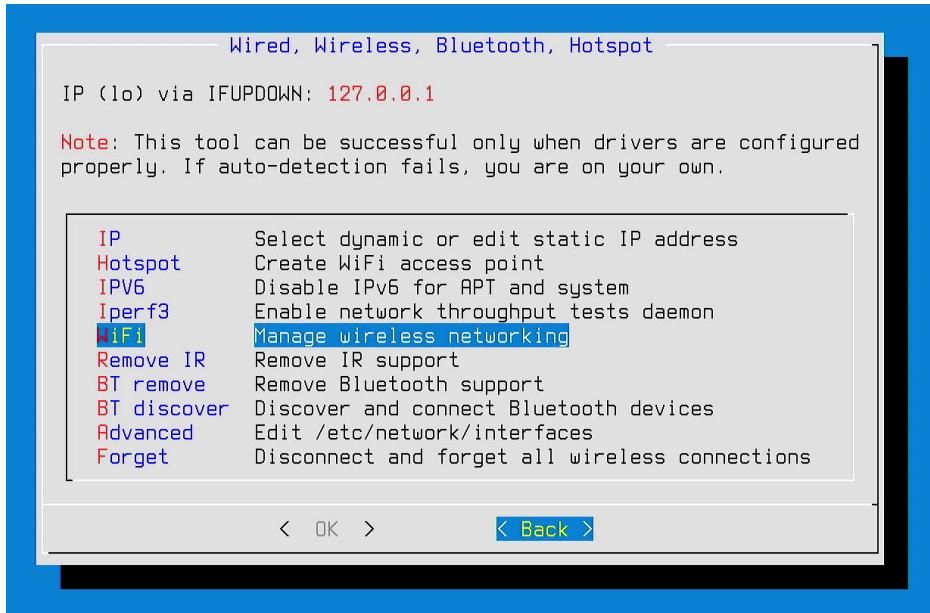
Enter your password at the prompt.



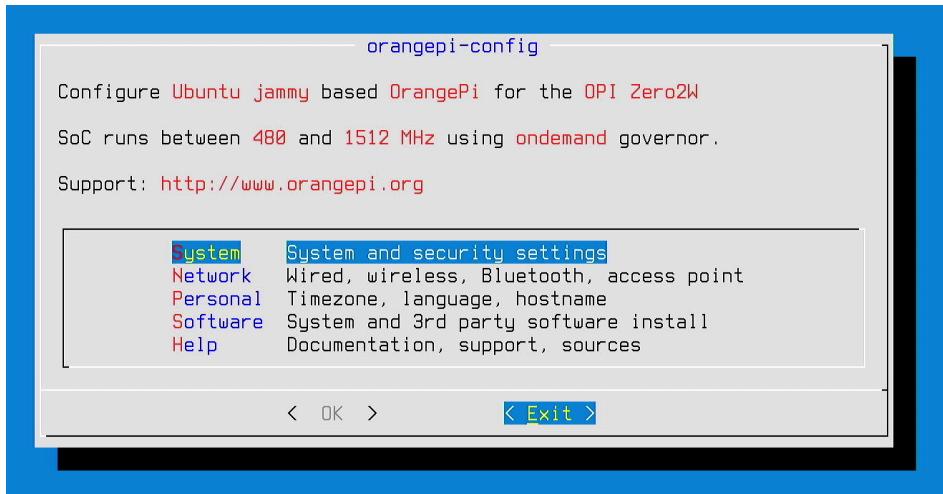
Use the arrow keys to select **Quit**, then press **enter**.



❑ Use the arrow keys to select **Back**, then press **enter**.



❑ Now select **Exit**. Then press **enter** to close the configuration menu.





Update your software

- ❑ Now that you're connected to the internet, you'll want to update your software packages. This step is important because some packages may need updates for security reasons.
- ❑ Type the command below (actually two commands separated by `&&`), then press **enter**.

```
sudo apt update && sudo apt -y upgrade
```

```
orangeipi@orangepizero2w:~$ sudo apt update && sudo apt -y upgrade
```

- ❑ Enter your password at the prompt and press **enter**. It may take 10+ minutes for your packages to download and update.

```
orangeipi@orangepizero2w:~$ sudo apt update && sudo apt -y upgrade
[sudo] password for orangeipi:
Hit:1 http://repo.huaweicloud.com/ubuntu-ports jammy InRelease
Get:2 http://repo.huaweicloud.com/ubuntu-ports jammy-security InRelease [110 kB]
Get:3 https://mirrors.aliyun.com/docker-ce/linux/ubuntu jammy InRelease [48.8 kB]
Get:4 http://repo.huaweicloud.com/ubuntu-ports jammy-updates InRelease [119 kB]
Get:5 http://repo.huaweicloud.com/ubuntu-ports jammy-backports InRelease [189 kB]
Get:6 http://repo.huaweicloud.com/ubuntu-ports jammy-security/multiverse armhf Packages [1,201 kB]
Get:7 http://repo.huaweicloud.com/ubuntu-ports jammy-security/restricted armhf Packages [14.8 kB]
Get:8 http://repo.huaweicloud.com/ubuntu-ports jammy-security/multiverse arm64 Packages [24.0 kB]
Get:9 http://repo.huaweicloud.com/ubuntu-ports jammy-security/universe armhf Packages [747 kB]
Get:10 http://repo.huaweicloud.com/ubuntu-ports jammy-security/main arm64 Packages [1,323 kB]
Get:11 http://repo.huaweicloud.com/ubuntu-ports jammy-security/universe arm64 Packages [1,088 kB]
Get:12 http://repo.huaweicloud.com/ubuntu-ports jammy-security/restricted arm64 Packages [1,383 kB]
Get:13 https://mirrors.aliyun.com/docker-ce/linux/ubuntu jammy/stable arm64 Packages [36.7 kB]
Get:14 http://repo.huaweicloud.com/ubuntu-ports jammy-security/main armhf Packages [736 kB]
Get:15 http://repo.huaweicloud.com/ubuntu-ports jammy-updates/multiverse arm64 Packages [28.4 kB]
Get:16 http://repo.huaweicloud.com/ubuntu-ports jammy-updates/restricted armhf Packages [16.0 kB]
Get:17 http://repo.huaweicloud.com/ubuntu-ports jammy-updates/main armhf Packages [999 kB]
Get:18 http://repo.huaweicloud.com/ubuntu-ports jammy-updates/universe arm64 Packages [1,276 kB]
Get:19 http://repo.huaweicloud.com/ubuntu-ports jammy-updates/universe armhf Packages [1,012 kB]
Get:20 http://repo.huaweicloud.com/ubuntu-ports jammy-updates/restricted arm64 Packages [1,402 kB]
Get:21 http://repo.huaweicloud.com/ubuntu-ports jammy-updates/multiverse armhf Packages [3,849 kB]
Get:22 http://repo.huaweicloud.com/ubuntu-ports jammy-updates/main arm64 Packages [1,593 kB]
Get:23 http://repo.huaweicloud.com/ubuntu-ports jammy-backports/universe armhf Packages [31.3 kB]
Get:24 http://repo.huaweicloud.com/ubuntu-ports jammy-backports/main arm64 Packages [80.5 kB]
Get:25 http://repo.huaweicloud.com/ubuntu-ports jammy-backports/universe arm64 Packages [31.3 kB]
Get:26 http://repo.huaweicloud.com/ubuntu-ports jammy-backports/main armhf Packages [80.5 kB]
Fetched 12.2 MB in 8s (1,535 kB/s)
Reading package lists... 9%
```



Update your hostname

A **hostname** is a short alphanumeric name for each device on a network, like a nickname. Setting a descriptive hostname will make it easier to tell which device is which, for example when using your router admin panel.

- To see your current hostname, enter the command `hostname` and press **enter**. The default hostname is `orangezero2w`.

```
orangepi@orangezero2w:~$ hostname  
orangezero2w  
orangepi@orangezero2w:~$ _
```

- Now run the command below, replacing **Zine-Gallery** with a descriptive name for your server (no spaces allowed, but hyphens are OK). You'll be prompted to enter your password.

```
hostnamectl set-hostname Zine-Gallery
```

```
orangepi@orangezero2w:~$ hostname  
orangezero2w  
orangepi@orangezero2w:~$ hostnamectl set-hostname Zine-Gallery
```



Set up a firewall

A firewall is a piece of software that restricts access to your device over the network. In this section you'll install and configure the firewall program `ufw`, short for Uncomplicated Firewall, which will monitor network requests and permit or deny each one depending on rules you set up.

- You'll start by installing `ufw`. Run the command `sudo apt install ufw`, then follow the prompts to finish installation.

```
orangepi@orangepizero2w:~$ sudo apt install ufw
```

- ❑ Run the command below to deny incoming network connections by default.

```
sudo ufw default deny incoming
```

```
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo ufw default deny incoming
```

- ❑ Run the command below to allow outgoing network connections by default.

```
sudo ufw default allow outgoing
```

```
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo ufw default deny incoming  
Default incoming policy changed to 'deny'  
(be sure to update your rules accordingly)  
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo ufw default allow outgoing
```

- ❑ Run the command below to allow incoming TCP connections on port 80:

```
sudo ufw allow 80/tcp
```

```
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo ufw default deny incoming  
Default incoming policy changed to 'deny'  
(be sure to update your rules accordingly)  
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo ufw default allow outgoing  
Default outgoing policy changed to 'allow'  
(be sure to update your rules accordingly)  
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo ufw allow 80/tcp
```

- ❑ Now run the command below to allow incoming TCP connections on port 22. This will make it possible to connect to your server via SSH, which we'll set up in a later section.

```
sudo ufw allow 22/tcp
```

```
orangepi@Zine-Gallery:~$ sudo ufw allow 22/tcp
Rule added
Rule added (v6)
orangepi@Zine-Gallery:~$ _
```

- ☐ Now run the command `sudo ufw enable` to turn on your firewall.

```
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo ufw default deny incoming
Default incoming policy changed to 'deny'
(be sure to update your rules accordingly)
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo ufw default allow outgoing
Default outgoing policy changed to 'allow'
(be sure to update your rules accordingly)
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo ufw allow 80/tcp
Rules updated
Rules updated (v6)
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo ufw enable
```

Install Apache HTTP Server

Next you'll install Apache HTTP Server, one of the most widely used web server programs. (*Note: The term "web server" can refer to a piece of software that serves websites, like Apache. "Web server" can also refer to the computer the software is running on.*)

- ❑ Run the command below to install Apache. You'll be prompted to enter your password.

```
sudo apt install apache2
```

```
orangepi@orangepizero2w:~$ sudo apt install apache2
```

Now you'll make a directory to store your website files in. The `mkdir` command makes a directory, and the `-p` option creates any parent directories in the path if they don't already exist.

- ❑ Type the command below to create the directory you'll use for your website files, replacing `zinegallery.iffybooks.net` with the domain you chose earlier.

```
sudo mkdir -p /var/www/zinegallery.iffybooks.net
```

```
orangepi@orangepizero2w:~$ sudo mkdir -p /var/www/zinegallery.iffybooks.net
```

- ❑ Use `chown` to set the current user (`orangepi`) as the owner of the directory you just created. Replace `zinegallery.iffybooks.net` below with the name of the directory you just created.

```
sudo chown -R $USER:$USER /var/www/zinegallery.iffybooks.net
```

```
orangepi@orangepizero2w:~$ sudo mkdir -p /var/www/zinegallery.iffybooks.net
orangepi@orangepizero2w:~$ sudo chown -R $USER:$USER /var/www/zinegallery.iffybooks.net/
```

- ❑ Now use `chmod` to set read-write-execute permissions for the directory `/var/www/`. The `755` option means only the owner (`orangepi`) can write to the directory, while all users will have read and execute permissions.

```
sudo chmod -R 755 /var/www/
```

```
orangepi@orangepirzero2w:~$ sudo mkdir -p /var/www/zinegallery.iffybooks.net  
orangepi@orangepirzero2w:~$ sudo chown -R $USER:$USER /var/www/zinegallery.iffybooks.net/  
orangepi@orangepirzero2w:~$ sudo chmod -R 755 /var/www/
```

- ❑ Use `cd` to change your current working directory to the directory you just created. (Tip: After typing `/var/www/` and the first letter or two of your directory name, press **tab** to autocomplete the rest of the pathname.)

```
cd /var/www/zinegallery.iffybooks.net/
```

```
orangepi@orangepirzero2w:~$ cd /var/www/zinegallery.iffybooks.net/
```

- ❑ Next you'll use the text editor `nano` to create a file called `index.html`. This will be the first page people will see when they visit your website.

```
sudo nano index.html
```

```
orangepi@orangepirzero2w:~$ cd /var/www/zinegallery.iffybooks.net/  
orangepi@orangepirzero2w:/var/www/zinegallery.iffybooks.net$ sudo nano index.html
```

- ❑ Now you'll type out some HTML code for a basic web page, just to use as a test. You can adapt the code below, or do a web search for example HTML code.

```
<!DOCTYPE html>
<html>
  <head>
    <title>Zine Gallery</title>
  </head>
  <body>
    <h1>Welcome to the Zine Gallery!</h1>
    <p>(still under construction!)</p>
  </body>
</html>
```

The screenshot shows a terminal window titled "GNU nano 6.2" with the file "index.html" open. The code is identical to the one shown above, with syntax highlighting for tags like <html>, <head>, <title>, <body>, <h1>, and <p>. The terminal window has a black background and white text.

```
GNU nano 6.2                               index.html *
<html>
  <head>
    <title>Zine Gallery</title>
  </head>
  <body>
    <h1>Welcome to the Zine Gallery!</h1>
    <p>(still under construction!)</p>
  </body>
</html>
```

- ❑ When you're ready to save your file, press **ctrl+X** to exit. Follow the prompts at the bottom of the screen to save the file.



Create an Apache configuration file

- Run the command below to change your current working directory to `/etc/apache2/sites-available`.

```
cd /etc/apache2/sites-available/
```

```
orangepi@orangepizero2w:/var/www/zinegallery.iffybooks.net$ cd /etc/apache2/sites-available/
```

- Type `ls` and press **enter** to see what files are in the current directory.

```
orangepi@orangepizero2w:/var/www/zinegallery.iffybooks.net$ cd /etc/apache2/sites-available/
orangepi@orangepizero2w:/etc/apache2/sites-available$ ls
000-default.conf  default-ssl.conf
orangepi@orangepizero2w:/etc/apache2/sites-available$
```

- Use `cp` to make a copy of the file `000-default.conf`. In the example below, the new file will be called `zinegallery.iffybooks.net.conf`. Yours should be the domain you chose earlier, followed by `.conf`.

```
sudo cp 000-default.conf zinegallery.iffybooks.net.conf
```

```
orangepi@orangepizero2w:/var/www/zinegallery.iffybooks.net$ cd /etc/apache2/sites-available/
orangepi@orangepizero2w:/etc/apache2/sites-available$ ls
000-default.conf  default-ssl.conf
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo cp 000-default.conf zinegallery.iffybooks.net.conf
```

- ❑ Now you'll use `nano` to open the configuration file you just created.

```
sudo nano zinegallery.iffybooks.net.conf
```

```
orangepi@orangepizero2w:/var/www/zinegallery.iffybooks.net$ cd /etc/apache2/sites-available/
orangepi@orangepizero2w:/etc/apache2/sites-available$ ls
000-default.conf  default-ssl.conf
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo cp 000-default.conf zinegallery.iffybooks.net.conf
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo nano zinegallery.iffybooks.net.conf
```

- ❑ Use your arrow keys to move the cursor to the line `DocumentRoot /var/www/html`. Delete `html` at the end and replace it with the name of the directory where your website files are located (i.e., the domain you chose). Here's an example:

`DocumentRoot /var/www/zinegallery.iffybooks.net`

```
GNU nano 6.2                                     zinegallery.iffybooks.net.conf *
<VirtualHost *:80>
    # The ServerName directive sets the request scheme, hostname and port that
    # the server uses to identify itself. This is used when creating
    # redirection URLs. In the context of virtual hosts, the ServerName
    # specifies what hostname must appear in the request's Host: header to
    # match this virtual host. For the default virtual host (this file) this
    # value is not decisive as it is used as a last resort host regardless.
    # However, you must set it for any further virtual host explicitly.
    #ServerName www.example.com

    ServerAdmin webmaster@localhost
    DocumentRoot /var/www/zinegallery.iffybooks.net  ←

    # Available loglevels: trace8, ..., trace1, debug, info, notice, warn,
    # error, crit, alert, emerg.
    # It is also possible to configure the loglevel for particular
    # modules, e.g.
    #LogLevel info ssl:warn

    ErrorLog ${APACHE_LOG_DIR}/error.log
    CustomLog ${APACHE_LOG_DIR}/access.log combined

    # For most configuration files from conf-available/, which are
    # enabled or disabled at a global level, it is possible to
    # include a line for only one particular virtual host. For example the
    # following line enables the CGI configuration for this host only
    # after it has been globally disabled with "a2disconf".
    #Include conf-available/serve-cgi-bin.conf

</VirtualHost>
```

← A large pink arrow points to the `DocumentRoot` line in the nano editor window.

⌘ H Help	⌘ O Write Out	⌃ W Where Is	⌃ K Cut	⌃ E Execute	⌃ C Location	M-U Undo
⌘ X Exit	⌃ R Read File	⌃ R Replace	⌃ U Paste	⌃ J Justify	⌃ Y Go To Line	M-B Redo

- ❑ Create two new lines above the one you just edited, and type out the following options. (If you decide to host more than one website on your server, you'll update these lines later.) When you're done, press **ctrl + X** and follow the prompts to save the file.

```
ServerName localhost  
ServerAlias localhost
```

```
GNU nano 6.2                                     zinegallery.iffybooks.net.conf *
```

```
<VirtualHost *:80>  
    # The ServerName directive sets the request scheme, hostname and port that  
    # the server uses to identify itself. This is used when creating  
    # redirection URLs. In the context of virtual hosts, the ServerName  
    # specifies what hostname must appear in the request's Host: header to  
    # match this virtual host. For the default virtual host (this file) this  
    # value is not decisive as it is used as a last resort host regardless.  
    # However, you must set it for any further virtual host explicitly.  
    #ServerName www.example.com  
  
    ServerAdmin webmaster@localhost  
    ServerName localhost  
    ServerAlias localhost  
    DocumentRoot /var/www/zinegallery.iffybooks.net  
  
    # Available loglevels: trace0, ..., trace1, debug, info, notice, warn,  
    # error, crit, alert, emerg.  
    # It is also possible to configure the loglevel for particular  
    # modules, e.g.  
    #LogLevel info ssl:warn  
  
    ErrorLog ${APACHE_LOG_DIR}/error.log  
    CustomLog ${APACHE_LOG_DIR}/access.log combined  
  
    # For most configuration files from conf-available/, which are  
    # enabled or disabled at a global level, it is possible to  
    # include a line for only one particular virtual host. For example the  
    # following line enables the CGI configuration for this host only  
    # after it has been globally disabled with "a2disconf".  
  
    ^G Help      ^O Write Out   ^W Where Is     ^K Cut          ^T Execute     ^C Location    M-U Undo  
    ^X Exit      ^R Read File   ^N Replace     ^U Paste        ^J Justify     ^V Go To Line  M-E Redo  
                                         M-A Set Mark  
                                         M-M Copy
```

► Set up ports.conf

- ❑ Run the command `cd /etc/apache2/` to change your current working directory to `/etc/apache2/`. Then use `ls` to view the directory's contents.

```
orangepi@orangepizero2w:/etc/apache2/sites-available$ cd /etc/apache2/  
orangepi@orangepizero2w:/etc/apache2$ ls  
apache2.conf  conf-enabled  magic          mods-enabled  sites-available  
conf-available envvars    mods-available  ports.conf    sites-enabled  
orangepi@orangepizero2w:/etc/apache2$
```

- ❑ Use the following command to open the configuration file `ports.conf` with the text editor `nano`.

```
sudo nano ports.conf
```

```
orangepi@orangepizero2w:/etc/apache2$ sudo nano ports.conf
```

- ❑ Find the line beginning with "Listen" and update it to match the line below. This change will expose your Apache website to other devices on your network.

```
Listen 0.0.0.0:80
```

```
GNU nano 6.2                                     ports.conf *
# If you just change the port or add more ports here, you will likely also
# have to change the VirtualHost statement in
# /etc/apache2/sites-enabled/000-default.conf

Listen 0.0.0.0:80

<IfModule ssl_module>
    Listen 443
</IfModule>

<IfModule mod_gnutls.c>
    Listen 443
</IfModule>

# vim: syntax=apache ts=4 sw=4 sts=4 sr noet
```



Enable your website

- Run the following command to have Apache enable your website:

```
sudo a2ensite zinegallery.iffybooks.net.conf
```

```
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo a2ensite zinegallery.iffybooks.net.conf
```

- Next, run this command to disable the site Apache runs by default:

```
sudo a2dissite 000-default.conf
```

```
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo a2ensite zinegallery.iffybooks.net.conf
Enabling site zinegallery.iffybooks.net.
To activate the new configuration, you need to run:
  systemctl reload apache2
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo a2dissite 000-default.conf
```

- Restart Apache with the following command:

```
systemctl reload apache2
```

```
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo a2ensite zinegallery.iffybooks.net.conf
Enabling site zinegallery.iffybooks.net.
To activate the new configuration, you need to run:
  systemctl reload apache2
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo a2dissite 000-default.conf
Site 000-default disabled.
To activate the new configuration, you need to run:
  systemctl reload apache2
orangepi@orangepizero2w:/etc/apache2/sites-available$ systemctl reload apache2
```



Find your IP address

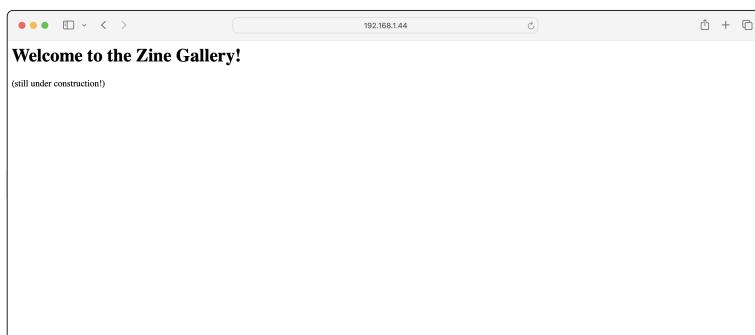
- Run the command `ip addr` to find your IP address on the local network. Look for a line beginning with `inet 192.168.`, which will be under `enx0...` if you're using Ethernet, or `wlan0` if you're using wi-fi. In the example below the server's local IP address is `192.168.1.46`.

```
orangepi@orangepirzero2w:/etc/apache2$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: eth0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc fq_codel state DOWN group default qlen 1000
    link/ether 7e:1b:f7:14:5b:e1 brd ff:ff:ff:ff:ff:ff
3: wlan0: <NO-CARRIER,BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state DORMANT group default qlen 1000
    link/ether 60:52:0e:a7:21:d0 brd ff:ff:ff:ff:ff:ff
4: enx00e04c3639f2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:e0:4c:36:39:f2 brd ff:ff:ff:ff:ff:ff
    inet 192.168.1.46/24 brd 192.168.1.255 scope global dynamic noprefixroute enx00e04c3639f2
        valid_lft 83007sec preferred_lft 83007sec
        inet6 fe80::ee94:9fe5:c052:2487/64 scope link noprefixroute
            valid_lft forever preferred_lft forever
orangepi@orangepirzero2w:/etc/apache2$
```



Test your site on the local network

- On a computer connected to the same network as your server, open a web browser, type the server's IP address in the address bar, and press **enter**. You should see your test website!





Set a static IP address

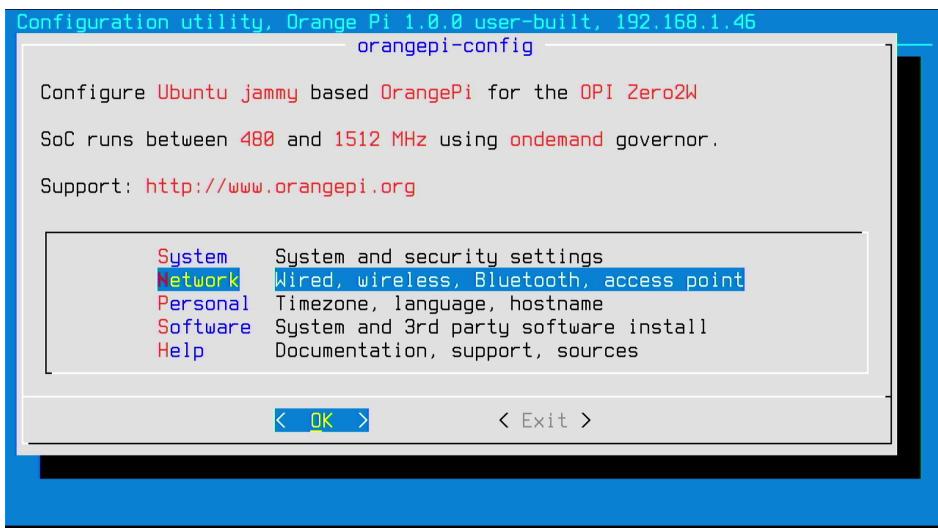
Typically, when you connect a computer to a network it's assigned a local IP address by a DHCP server program running on the router. Every time you connect, your machine will be given an arbitrary address that isn't already taken, typically beginning with `192.168`.

Alternatively, your computer can announce its own static IP address, which never changes. In this case you'll need a static IP address to set up port forwarding, which we'll cover in a future step.

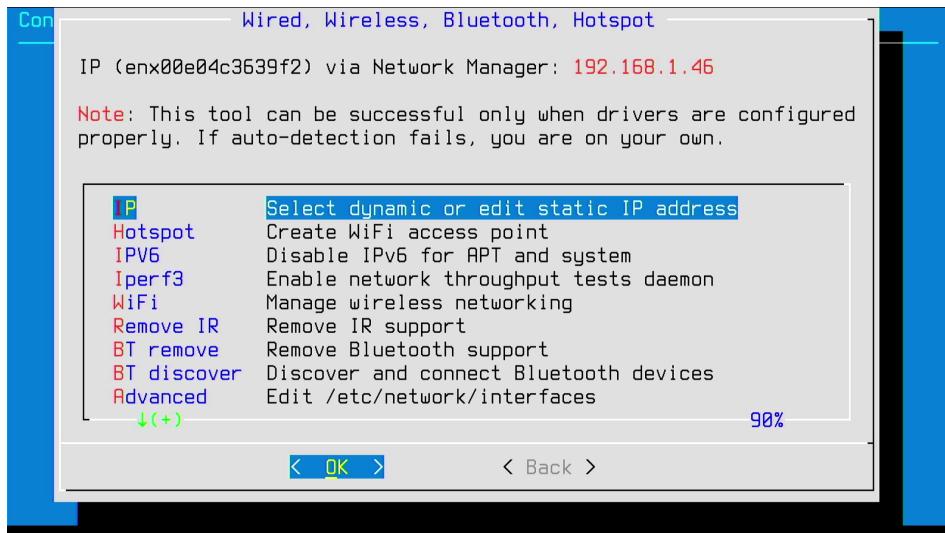
- Run the command `sudo orangepi-config` to launch the Orange Pi configuration utility.

```
orangepi@Zine-Gallery:~$ sudo orangepi-config
```

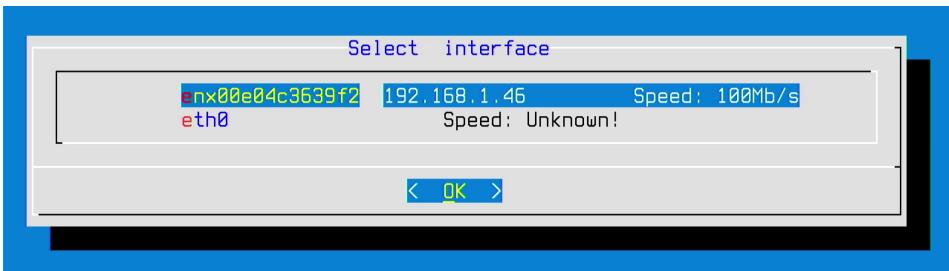
- Select the `Network` menu and press **enter**.



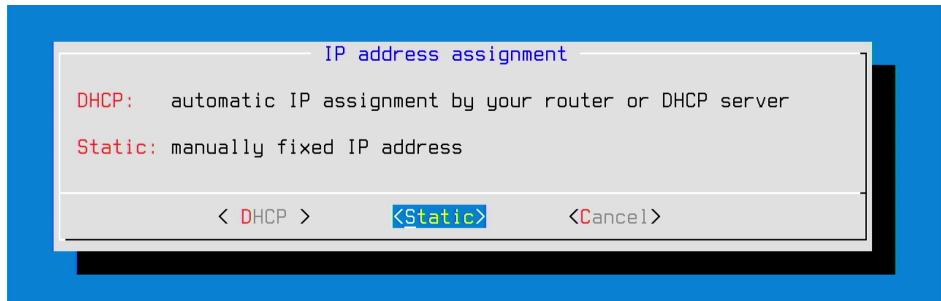
- Select **IP** and press **enter**.



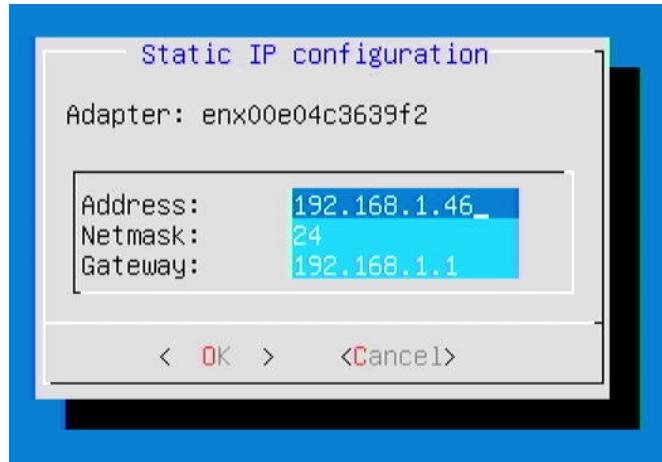
- Select the **enx0...** option if your computer is connected via Ethernet.



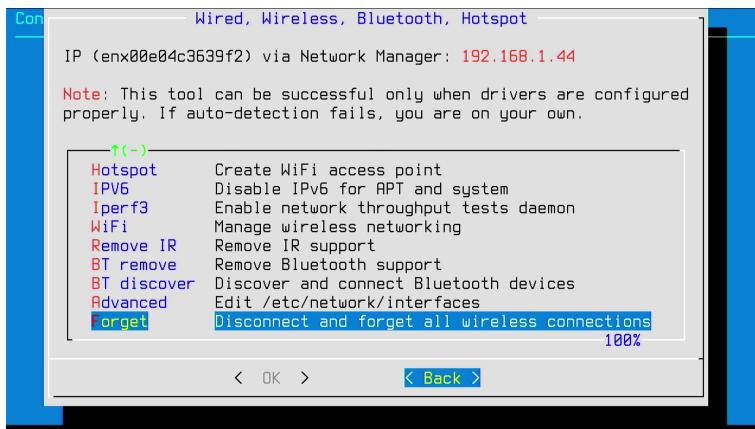
- Select **Static** and press **enter**.



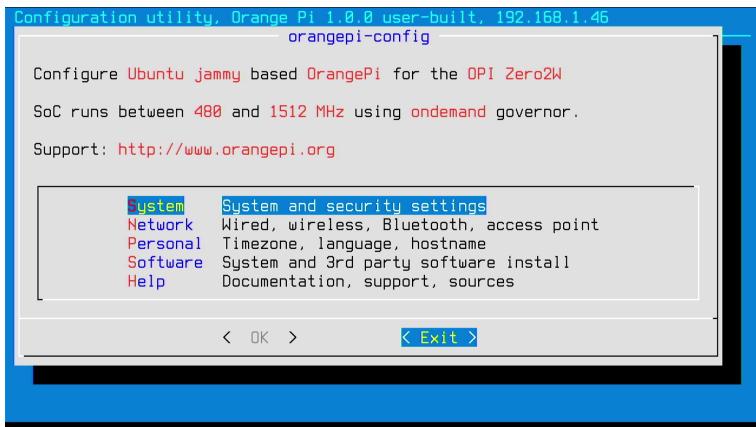
☐ Next to **Address**, enter the local IP address you'd like to use. It should begin with 192.168.1. and end with a number from 2 to 254. You may want to leave this option as-is, because you know your DHCP-assigned IP address isn't being used by another device. Press **enter** to save your configuration.



☐ Select **Back** and press **enter**.



- ❑ Select **Exit** and press **enter** to close the configuration utility.



▶ Enable local SSH access

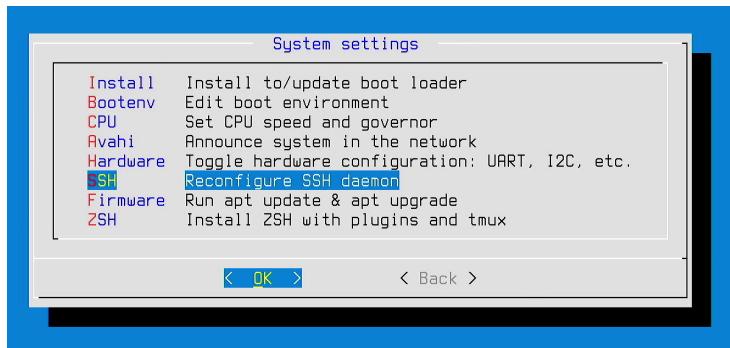
- ❑ Run the command `sudo orangepi-config` to open the Orange Pi configuration utility.

```
orangepi@orangepizero2w:/etc/apache2/sites-available$ sudo orangepi-config
```

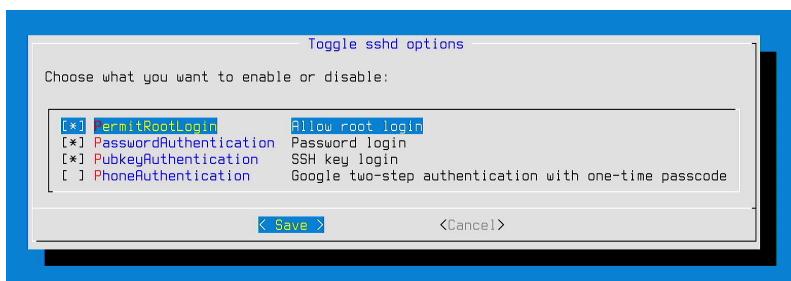
- ❑ Select **System** and press **enter**.



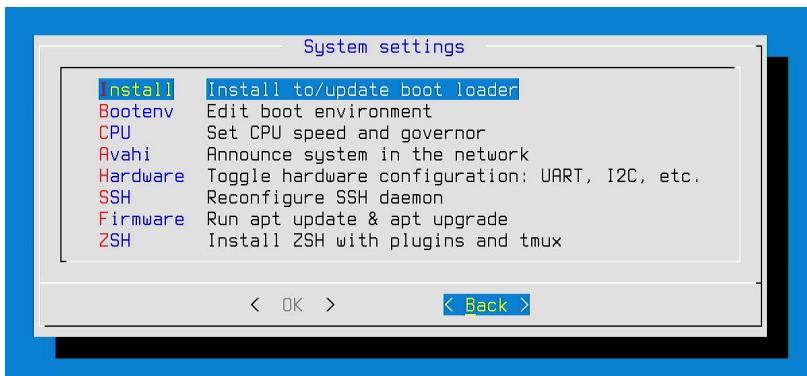
❑ Select **SSH** and press **enter**.



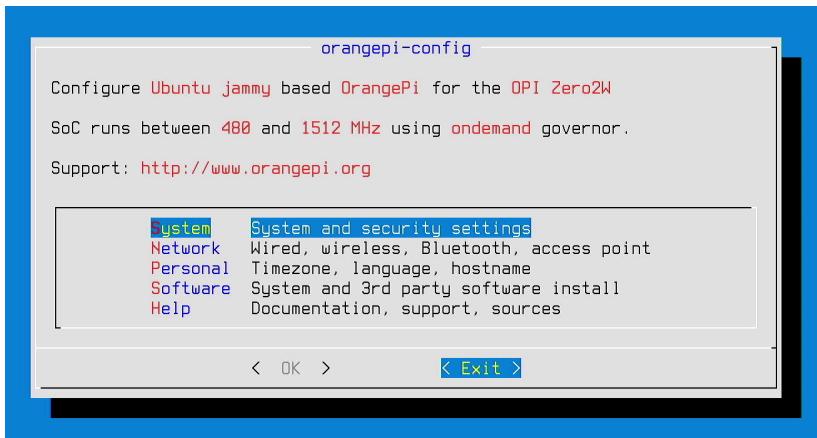
❑ The first three options (PermitRootLogin , Password Authentication , and PubkeyAuthentication) should be selected by default. Move your cursor to **Save** and press **enter** to enable SSH access.



❑ Select **Back** and press **enter**.



- ❑ Select `Exit` and press **enter** to close the configuration utility.



► Reboot

- ❑ Type the command `reboot` and press **enter** to reboot your computer.

```
orangepi@orangepizero2w:/etc/apache2/sites-available$ reboot
```

► Test your SSH connection

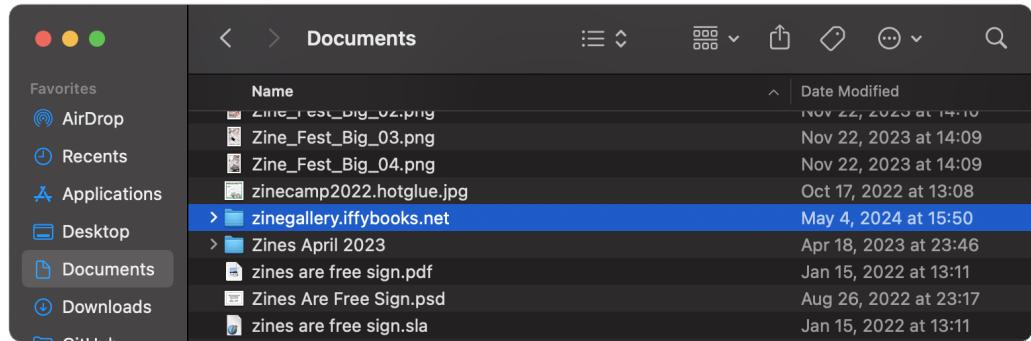
- ❑ From a terminal window on your desktop computer, run the following command to start an `ssh` session with your server.

```
ssh orangepi@192.168.1.44
```

- ❑ When you're done, you can use the command `exit` to end the ssh session.

▶ Update your website from another computer using scp

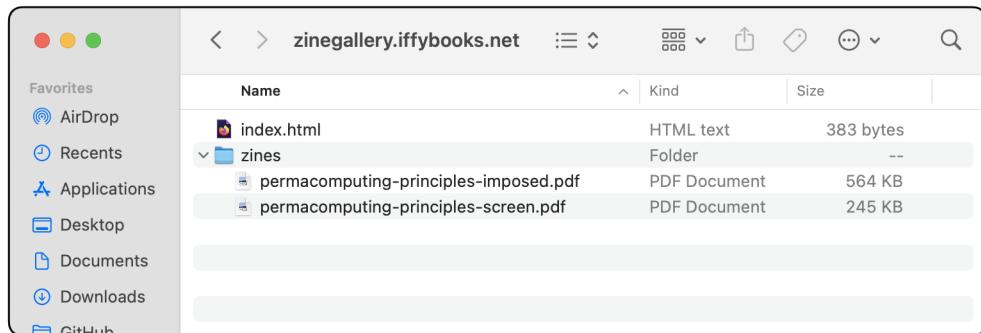
- On your desktop computer, go to `Documents` and create a directory with the same name as the domain/subdomain you're using. In the example below, the directory is called `zinegallery.iffybooks.net`.



- Open a plaintext editor and write some HTML for a new home page. (In the example below we're using Sublime Text.)

```
index.html
<html>
  <head>
    <title>Zine Gallery</title>
  </head>
  <body>
    <div width="70%" align="center">
      <h1>Welcome to the Zine Gallery!</h1>
      <ul>
        <p>
          <b>Permacomputing Principles</b><br />
          <a href="zines/permacomputing-principles-screen.pdf">Screen</a>
          <a href="zines/permacomputing-principles-imposed.pdf">Print-imposed</a>
        </p>
      </ul>
    </div>
  </body>
</html>
```

- ❑ Save the file to the website directory you just created, with the name `index.html`.
- ❑ If you want, add more pages, images, and files to your website directory. The example page we created above includes links to two PDF files.

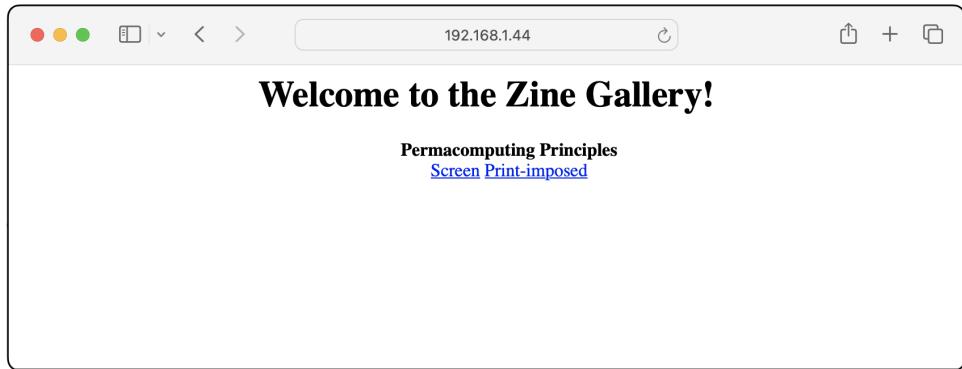


- ❑ Open a terminal window on your desktop computer and type out a command like the one below, substituting your website directory name and the local IP address you're using. Press **enter**. You'll be prompted to enter the root password for your single-board computer.

```
scp -r ~/Documents/zinegallery.iffybooks.net/
root@192.168.1.46:/var/www/
```

```
iffybooks@MacBook-Pro ~ % scp -r ~/Documents/zinegallery.iffybooks.net/ orangepi
@192.168.1.46:/var/www/
```

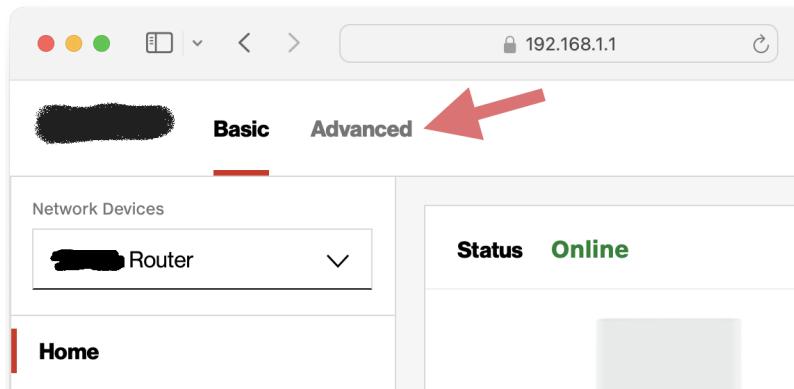
- ❑ Open a browser window on your desktop computer, type your server's IP address in the address bar, and press **enter**. You should see your updated site!



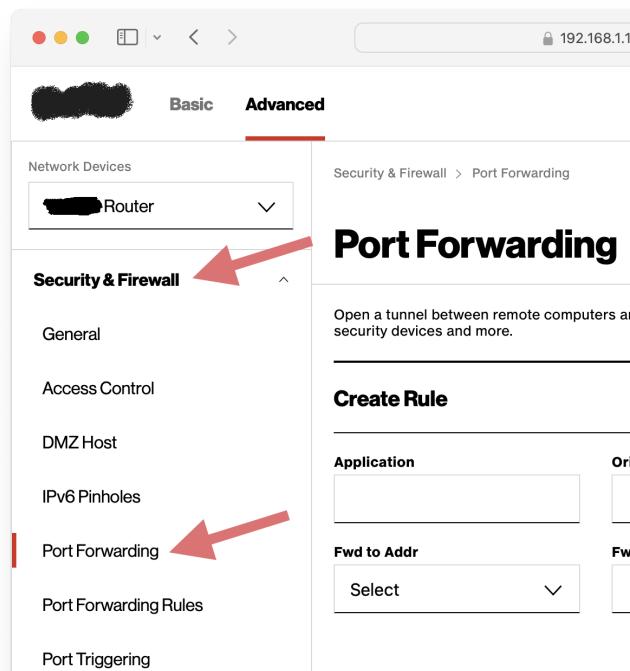
Set up port forwarding on your router

- ❑ Open a web browser on a desktop computer and enter the IP address for your home router's admin panel. There's a good chance the IP address is 192.168.1.1 . Press **enter**, then log in with your admin password. (The admin password may be printed on the back of your router, depending on your ISP.)

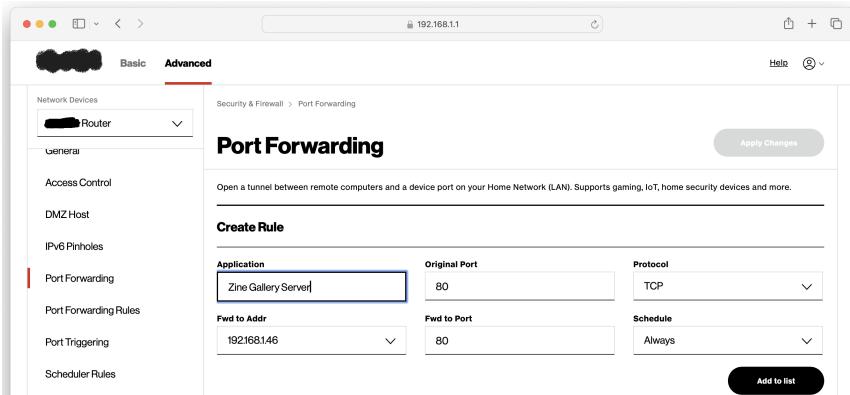
- ❑ If your ISP is V******, you'll need to click **Advanced** at the top of the window to switch to the advanced admin panel.



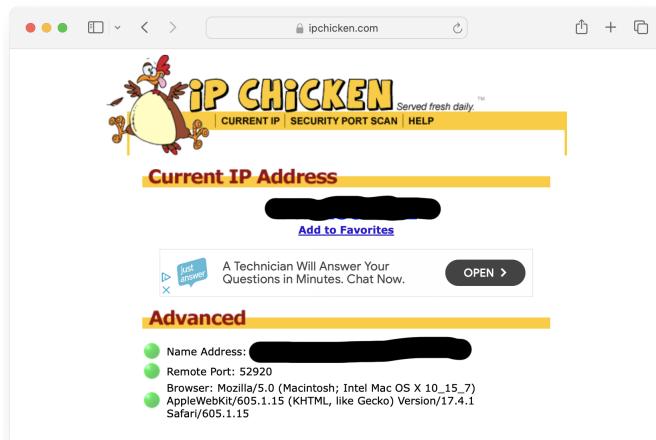
- ❑ Navigate to **Security & Firewall**, then **Port Forwarding**.



- ❑ Under **Application**, give your server a name. The example is called **Zine Gallery Server**. For **Original Port** and **Forward to Port**, enter **80**. **Protocol** should be set to **TCP**. Under **Fwd to Addr**, type the static IP address you chose for your server. Under **Schedule**, Select **Always**.



- ❑ When you're done, click **Add to list** to create your port forwarding rule. Then click **Apply Changes**.
- ❑ To confirm port forwarding works, go to **ipchicken.com** and find your home IP address.



- ❑ Copy and paste your home IP address into the URL bar and press **enter**, and you should see your website.



Set up DDNS for your domain or subdomain

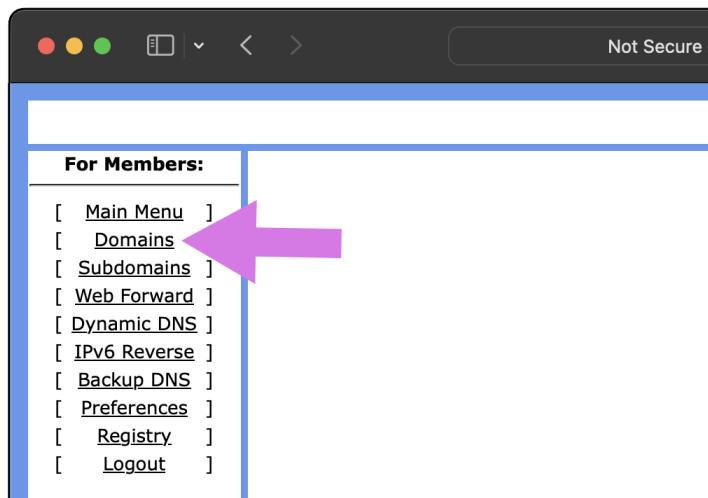
- Go to freedns.afraid.org. Scroll down and click **Sign up Free**.

The screenshot shows the homepage of freedns.afraid.org. At the top right, there's a "Sign up Free" button. Below it, there's a "Premium Plans" button. On the left, there's a sidebar with links like Home, About Us, FAQ, News, DNS Stats, AUP/TOS, and Contact. The main content area has sections for "Free DNS, Dynamic DNS, Static DNS and Premium DNS services", "Feature List:", and "Tip #1". It also includes a "Signup Q&A" section and a "Powered by FreeBSD" logo.

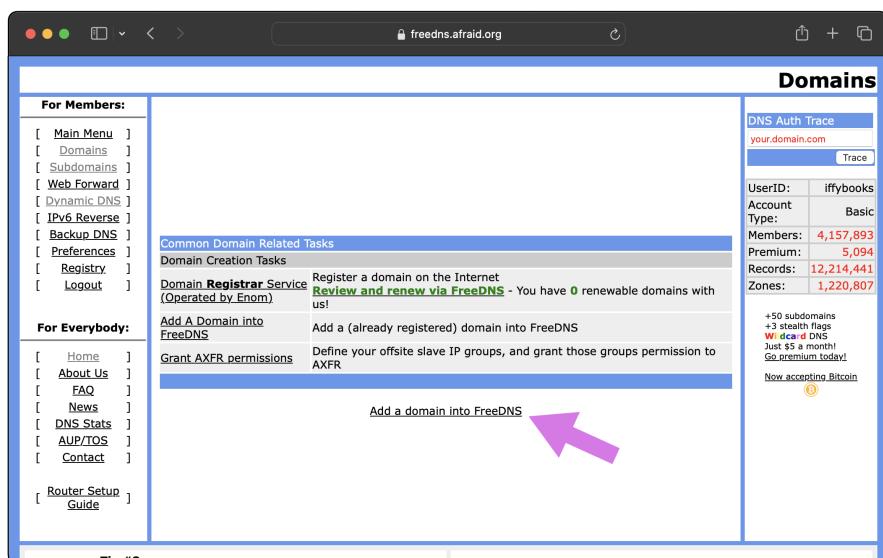
- Enter your info to create a new account.

The screenshot shows the "Create your account" form. It has fields for First Name, Last Name, UserID, Password, and Password (confirm). There's also an "E-Mail" field and a CAPTCHA image. A checkbox for "I agree to abide by the Terms and Conditions" is present, along with a "Send activation email" button. To the right, there's a sidebar with account statistics: Members: 4,157,892, Premium: 5,094, Records: 12,214,449, and Zones: 1,220,807. It also mentions "+50 subdomains", "+3 stealth flags", "With 100% DNS", "Just \$5 a month!", and "Go premium today!". A note at the bottom says "Now accepting Bitcoin".

- ❑ Open your email and follow the confirmation link.
- ❑ Go back to `freedns.afraid.org` and click **Domains** in the left column.



- ❑ Click **Add a domain into FreeDNS.**



- ☐ In the text box at the top of the page, enter the domain or subdomain you're using. Then select **Shared: Private** from the dropdown menu below. Click **Submit**.

The screenshot shows the 'Domain Manager' interface for a user account named 'iffybooks'. The 'DNS Auth Trace' sidebar on the right displays account statistics: UserID: iffybooks, Account Type: Basic, Members: 4,157,893, Premium: 5,094, Records: 12,214,441, and Zones: 1,220,807. The main content area shows the 'Add a domain' form with the domain 'zinegallery.iffybooks.net' entered, 'Shared State' set to 'Shared: Private', and a 'Submit' button. A note says 'NOTE! You must register your domain with these name servers:' followed by 'NS1.AFRaid.ORG', 'NS2.AFRaid.ORG', 'NS3.AFRaid.ORG', and 'NS4.AFRaid.ORG'. Below this, a warning about using only one nameserver is present. Further down, instructions for adding multiple domains are given.

- ☐ The next page will confirm that your domain has been added to the system. It also says your domain has been temporarily marked as broken, which is normal.

The screenshot shows the 'Addition Success!' confirmation page. The 'DNS Auth Trace' sidebar on the right shows the same account statistics as before. The main message states 'Domain zinegallery.iffybooks.net has been added to the system.' and 'Domain has been marked as BROKEN until the nightly check verifies the domain is properly delegated to afraid.org.' Below this, a note explains what 'BROKEN' means and ends with 'Enjoy!'. The bottom of the page has a footer with the text 'Tip #2'.

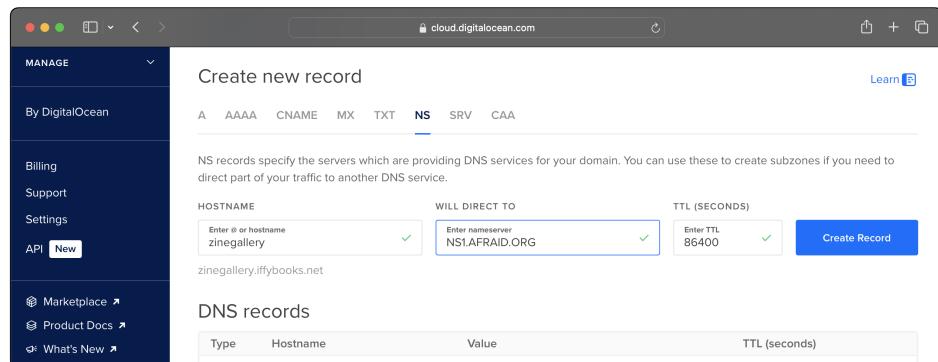
☐ Next you'll update your domain records to use the following name servers for your domain/subdomain:

- NS1.AFRAID.ORG
- NS2.AFRAID.ORG
- NS3.AFRAID.ORG
- NS4.AFRAID.ORG

If you're using a domain you just registered, you can update your domain records on the site where you registered it. If you used GoDaddy, for example, open your **Domain Portfolio** and click on a domain to open **Domain Settings**. Then click on the **DNS** tab.

If you're creating a subdomain with a domain you're already using, you can update your domain records through your VPS provider or hosting service. On DigitalOcean, for example, you can find domain settings under **Manage > Networking > Domains**.

☐ Create a new **NS** (name server) record for the domain or subdomain you're using, and enter `ns1.afraid.org` as the same server. Click **Create Record**.



- ☐ Repeat the previous step, creating three more NS records with the following name servers: ns2.afraid.org , ns3.afraid.org and ns4.afraid.org . You'll enter the same subdomain every time.

DNS records				
Type	Hostname	Value	TTL (seconds)	
NS	zinegallery	directs to ns4.afraid.org	86400	More ▾
NS	zinegallery	directs to ns3.afraid.org	86400	More ▾
NS	zinegallery	directs to ns2.afraid.org	86400	More ▾
NS	zinegallery	directs to ns1.afraid.org	86400	More ▾

Install ddclient

Next you'll install ddclient , a program that intermittently checks your single-board computer's IP address. If it changes, ddclient will update your DDNS provider.

- ☐ On your single-board computer, run the following command to install a software package you'll need to use ddclient . Type y at the propmpt and press **enter** to confirm.

```
sudo apt install libio-socket-ssl-perl
```

- ☐ Run the command below to install ddclient . Type y at the propmpt and press **enter** to confirm.

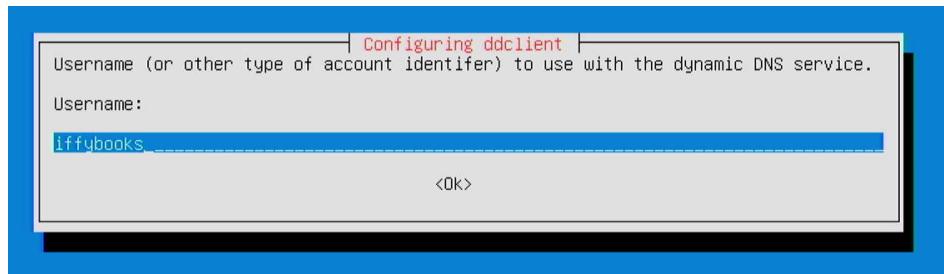
```
sudo apt install ddclient
```

```
orangepi@Zine-Gallery:/var/www/zinegallery.iffybooks.net$ sudo apt install ddclient
```

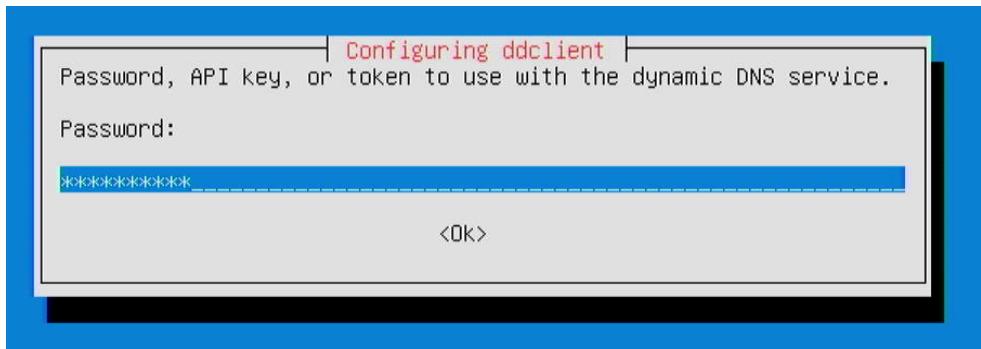
- ❑ After installation, a setup wizard will launch. Use your arrow keys to select **freedns.afraid.org** from the list of DDNS providers. Press **enter** to continue.



- ❑ Now enter the username for your account on **freedns.afraid.org**.



- ❑ Type our your **freedns.afraid.org** account password and press **enter**. You'll be prompted to enter your password again to confirm it.



- ❑ Select **Web-based IP discovery service**, then press **enter** to continue.

```
Configuring ddclient
The method ddclient uses to determine your current IP address. Your options:

Web-based IP discovery service: Periodically visit a web page that shows your IP address. You probably want this option if your computer is connected to the Internet via a Network Address Translation (NAT) device such as a typical consumer router.

Network interface: Use the IP address assigned to your computer's network interface (such as an Ethernet adapter or PPP connection). You probably want this option if your computer connects directly to the Internet (your connection does not go through a NAT device).

IP address discovery method:
    Web-based IP discovery service
    Network interface

<Ok>
```

- ❑ Type out the domain/subdomain you're using and press **enter**.

```
Configuring ddclient
Comma-separated list of fully qualified domain names to update (for instance, "myname.dyndns.org" with only one host, or "myname1.dyndns.org,myname2.dyndns.org" for two hosts).

Hosts to update (comma-separated):
zinegallery.iffybooks.net
                                         ↓
                                         ↵
                                         <Ok>
```

- ❑ Finally, run the command below to have `ddclient` check your current IP address every 5 minutes.

```
sudo ddclient -daemon 5m
```

```
orangepi@Zine-Gallery:~$ sudo ddclient -daemon 5m
```

If you don't see any error messages when you run this command, that's a good thing. It means `ddclient` is running properly.

- ❑ Now go to a browser on your desktop computer and enter your domain or subdomain in the URL bar. You should see your website! If not, wait five minutes for DNS servers to update and try again.



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