## Sources


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## A guide for building





Guide for building The Mutable Net


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# Introduction

This guide was written as part of the collectively-built archive A Repository for the Mutable Net. It accompanies the Hacking Devices research lab, inspired by the practice of infrastructural building of Wireless Community Networks.

The guide documents the process of flashing a routing device with free and open-source software. It will start with the installation of OpenWrt, then with LibreMesh turning a commercial router into a node of a communitarian meshed system.

The instructions are organised around tasks. Each task combines a set of actions to perform with a space for notes — the *Node Sheet* — in order to make the processes generated by the attempts at interacting with this shared technology part of a shared documentation. Errors and technical issues are seen here as an experience to trace different roads in the literacy that composes the ecosystem of knowledge that the project aims to develop.

# Note of the author

I am an inexperienced individual trying to experiment with building a mesh network, starting from hacking routing devices. I am a designer and, first of all, I am currently a student, meaning my interest is to learn and gain knowledge. I have no previous expertise in what I am reporting here, meaning that everything I know came from research. My objective is to try to provide a different kind of guide, one that can hopefully help you follow my steps, while also making clear that this is something that can be done with care and effort by anyone.



## Index of /

1. ../
   modified: Wed, 25 Mar 2026 20:11:16 GMT
   directory - 0.00 kbyte
2. cgi-bin/
   modified: Wed, 25 Mar 2026 20:09:53 GMT
   directory - 0.07 kbyte
3. docs/
   modified: Wed, 25 Mar 2026 20:09:53 GMT
   directory - 0.04 kbyte

**Notes**

# The Mutable Net

## Task/07

» Check the available wifi networks on your laptop or phone. If the LibreMesh installation was successful, a new access point with “libremesh.org” in its name should appear in the list of nearby networks. Note in your whether you can see it or not.

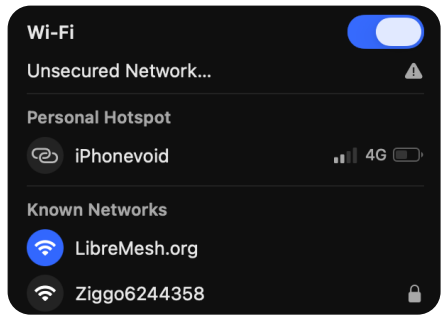
» If it does not appear, write down what happened during the installation, what the device showed on screen, which steps you followed, and whether any of them seemed to work or not.

» If you can see the network, connect to it and try opening *http://thisnode.info* in your browser. Note in your *Node Sheet* whether the page loads or not.

## Guide

**Installing LibreMesh**

LibreMesh does not always display a clear confirmation message when the installation is complete. In my case, the interface never told me it had finished, I only found out by checking the available wifi networks on my laptop and noticing a new access point with “libremesh.org” in its name.




I connected to that network and typed http://thisnode.info into Safari. A very minimal page opened. If you installed the mini version of LibreMesh, this is completely normal; there is no full interface, just a basic information page. This is still a confirmation that everything worked: your device has successfully become a mesh node.

If you do not see a libremesh.org network appearing after 5 minutes, wait a little longer before assuming something went wrong. The router needs a few minutes to fully restart after flashing.

## Notes



# A Repository for the Mutable Net

*A Repository for the Mutable Net* is a collectively-built repository on the practice of Wireless Community Networks. It is aimed at creating a space to archive experimentation and gather critical, conceptual and practical knowledge on alternative infrastructures. As results of a lab series the outcomes can be explored and integrated with new materials on the pages of the *Repository for the Mutable Net* contains.

The virtual repository can be accessed at the following link: **mutablenet.xyz**

# Some base definitions

**What is a Operating System?**

An operating system is the fundamental software that operates the hardware and enables the execution of other programs on the device. The operating system is the “bridge” between the physical hardware (circuits, chips, memory, etc.) and everything else you do with the device. In the case of the router, there is an operating system installed on the device by the manufacturer. This operating system is used to route the information on the device, connect information, and communicate with other devices. Without the operating system, the hardware is useless.

**What is a Firmware?**

When one purchases a commercial router, it comes with the manufacturer’s own firmware, which is essentially the embedded OS. It is this firmware that runs the show, including the security features. It is the brain behind the entire operation. Unfortunately, it is closed-source, which means one is unable to view the code, alter it, or even use it for something other than what the manufacturer intended. It is essentially the user being stuck with what the manufacturer intended the product to do. It is relevant to your thesis because it is the same logic behind privatized infrastructure.

**What is Open-WRT?**

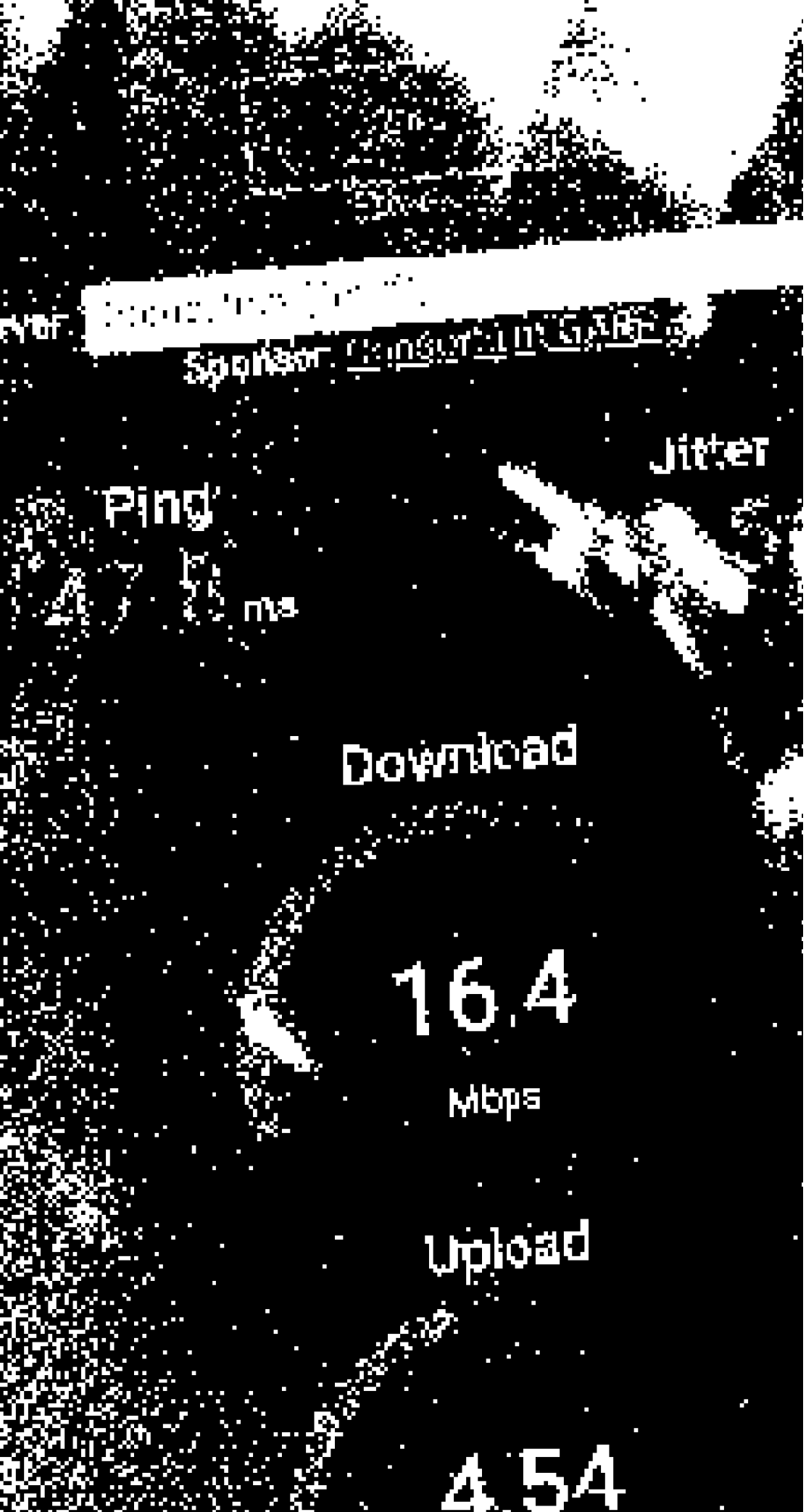
OpenWrt is a customizable operating system based on Linux, designed for embedded devices. Unlike other firmware, which is a fixed operating system, OpenWrt is a Linux-based operating system that enables applications to be added or removed as needed without having to rebuild the firmware. OpenWrt was originally developed as a solution to allow users and developers to control router firmware. Essentially, what happens when you install OpenWrt on your device is that you “flash” it, which means replacing its original software with an alternative open-source software. This gives one the freedom to bypass the application and configuration options offered by the manufacturer and customize the device to a community’s needs. So it is no longer seen as something which can only be used for the purposes intended by the manufacturer, but as something which can be completely reprogrammed.

**What is Libremesh?**

LibreMesh is a modular framework for creating OpenWrt-based firmwares for wireless mesh nodes. It aims at enabling non-expert users to set up a mesh network and perform basic configuration and management via a web interface and to encourage non-expert users to empower themselves deepening their technical understanding of mesh networks.

Task/
07




Jitter
Ping
ms
Download
16.4
Mbps
Upload
4.54

## Task/01

Check and transfer on the Note Sheet the following information. Most of it can be found directly on your device, either on its surface or physical body. For the rest, you can explore the official information page of your device by checking the model and the brand,
Check:

» The brand.

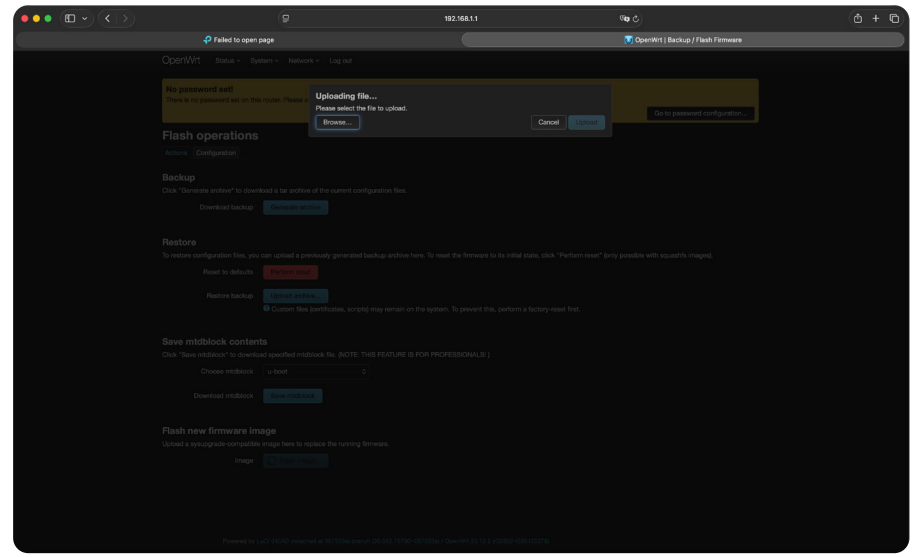
» Year of Production.

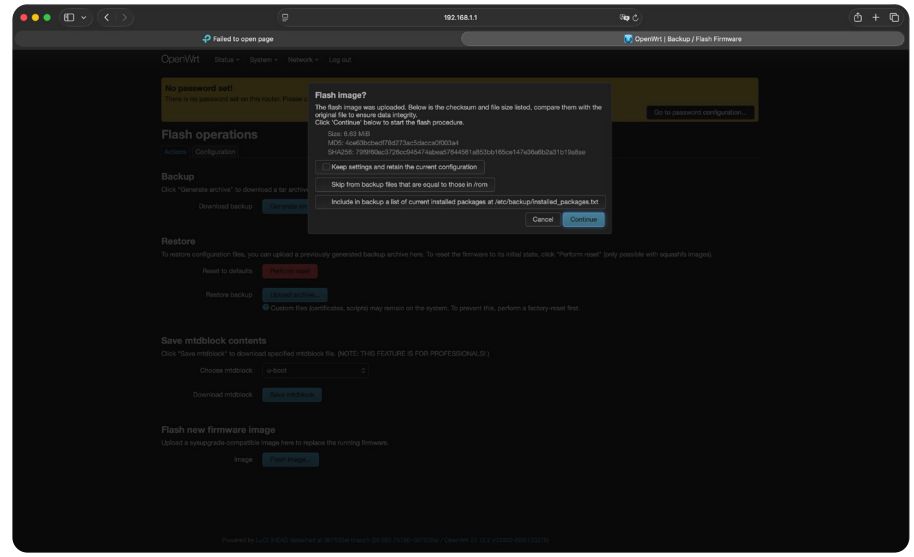
» The device model and hardwware version (e.g. v1, v2), usually on a sticker underneath the router.

» The way the device behaves when connected to your laptop (which lights are on and which icons appear). Extend with a quick description of the appearance of the device.

» Chek the amount of “flash memory”[01] of your device (e.g. 8MB, 16MB).

» Extra findings you consider relevant to share.




01 » Flash memory is the storage built into the router where the firmware is saved. The flash memory stores data permanently meaning that the  the firmware is still there every time you restart the device.

## Notes

## Notes

## Task/06

» Follow the passages below and note if any error occoured and, eventually how you fixed it.

» Describe the way both the user interface and your router behaves during the installation of the Libremesh framework (pop-ups, flashing lights, duration etc.)

## Guide

**Installing LibreMesh**

Make sure your router is connected to your laptop via ethernet cable. Open Safari and type *http://192.168.1.1* into the address bar, this is the OpenWrt interface you installed in the previous steps. If this does not load, refer to the network settings section in the OpenWrt guide.

Once logged in, click *System* in the top navigation bar and select *Backup / Flash Firmware* from the dropdown menu.

*System -> Backup / Flash Firmware*

Scroll down to the section called *Flash New Firmware Image* and click *Flash Image*. A file browser will open, select the LibreMesh *Sysupgrade* file you downloaded earlier from your firmware folder and click Upload.

A new window will appear asking you to confirm the installation. Uncheck all the checkboxes and click Continue.

The router will now show a *"Flashing..."* message. This process takes several minutes, in my case I waited around 10 minutes. Do not unplug the router or close the browser while this is happening, even if nothing seems to be occurring on screen.

## Notes



## Notes

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ect the path name where

.

**grade** button.

will reboot while the upgrad

- Displays the current firmw

- Displays the current hard
ent hardware version.

version must correspond
tarts automatically when th
ocess. Loss of power during



## Task/02

» Follow the steps below and document your process as you go. In the *Node Sheet*, note any form of error you encountered: be specific about what went wrong, how you fixed it, and which sources, tutorials, or people helped you find the solution. Errors and dead ends are as valuable as successes: they potentially are the most useful part of the docu mentation for anyone who will repeat this process after you.

» Note if you easily managed to access the router's log in interface.

» Provide a quick description of the interface itself.

» Control the current firmware version of your device.

## Guide

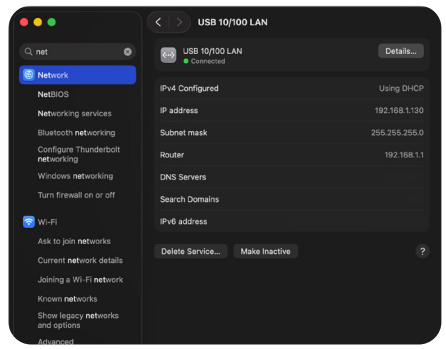
Connect the router to your laptop using an *ethernet cable*, inserting it into one of the *yellow ports* on the connectivity device on one end. If your laptop does not have an ethernet port, you can use the *Ethernet to USB-A* adapter. Once connected, check if any new lights turn on on your router.

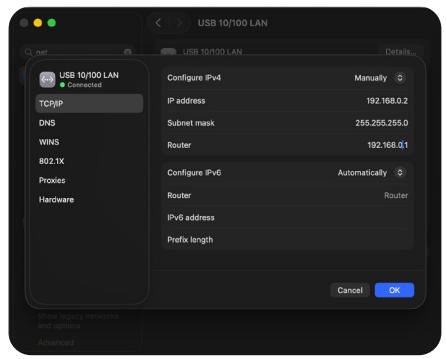
To access the router's internal storage, open a web browser on your computer. If you are on macOS, use *Safari*. If you are on Windows, use Internet Explorer or Edge, as these tend to cause fewer issues than other browsers. In the address bar, type *192.168.0.1* and press enter. A TP-Link login page should appear.

If the page does not load, on *macOS*, go to:

*System Settings -> Network -> USB 10/100 LAN (or Ethernet)*

If the router is connected, this should appear near the top of the list with a green dot on its left. Click Details on the right.

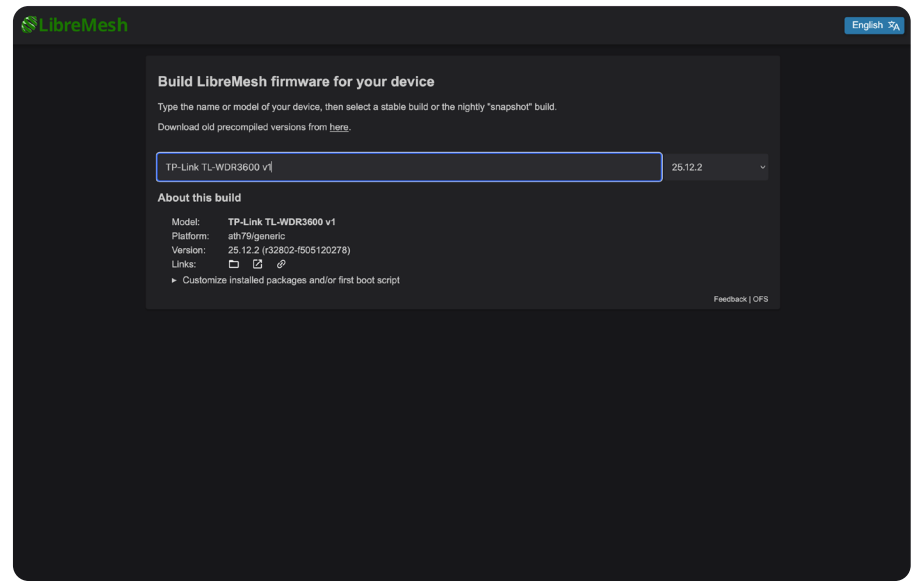


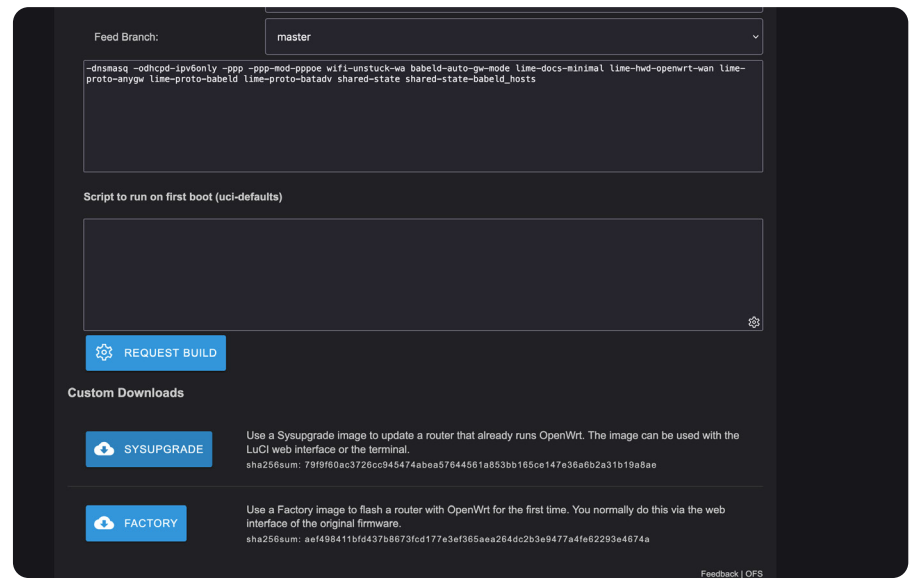




02 » TCP/IP is the communications protocol that outlines how information is sent from one device to another over a network. The function of TCP is to break down information into packets and ensure they reach their destination, while IP is responsible for routing the packets, figuring out where they need to be delivered, and how to deliver them.

03 » DHCP (Dynamic Host Configuration Protocol) is a protocol that automatically assigns a network address to your device when it connects to a router. Without it, every device would need to be configured manually to communicate on the network. Whenever you choose "Manually" in the network configurations, it means that you're assigning address values by yourself without relying on DHCP.

## Notes




## Notes

## Task/05

» Open your browser and go to *firmware-selector.libremesh.org*. Search for your device model and verison and select it. Then write down the exact name and chosen settings you used for generating the Librelmesh version.

» If you encounter any trouble, note down the specific error and how you fixed it.

## Guide

**Check Device Compatibility and Download LibreMesh**

Open the LibreMesh Firmware Selector at *firmware-selector.libremesh.org*. Type your device model into the search bar and see if it appears. If it does, your device is compatible.

Once you select your device, click "Customize Installed packages and/or first boot script". The page will expand showing several options. The main one to pay attention to is Flavor, which determines the size of the firmware file that will be built. If your device has limited storage, the *default* size will be too large and the selector will tell you it cannot build the firmware. In that case, switch Flavor to *mini* and try again.

The selector builds a firmware file specifically for your device in the moment you press the button, it is not a pre-existing download. This means you need to wait a few minutes while it builds.

Once the build is ready, click *Sysupgrade* and a download will start. Save this file in your firmware folder alongside the *OpenWrt* file.

Note in your flashing sheet which Flavor you used and whether the build succeeded on the first try or required changes.

## Notes





In the window that opens, go to *TCP/IP*[02]. You will see a dropdown currently set to *Using DHCP*.[03] Click it and select Manually. Now enter the following three values:

*IP Address: 192.168.0.2*

This is your laptop's identity on the local network, like a house number. By You are manually telling your laptop "your address is .0.2" instead of letting the router assign one automatically.

*Subnet Mask: 255.255.255.0*

This defines "the neighbourhood" which devices can talk to each other directly. All devices starting with *192.168.0.* are in the same neighbourhood and can communicate.

*Router: 192.168.0.1*

This tells your laptop where the exit of the network is: the device that forwards traffic outward. You are pointing it to the TP-Link's address.

Click OK in the bottom right corner of the window. Your laptop should now be able to communicate with the router.

Note for Windows users: the steps below for adjusting network settings are written for macOS. On Windows, you can reach the equivalent settings by going to:

*Control Panel -> Network and Internet -> Network Connections*

Then right-clicking your ethernet connection and selecting:

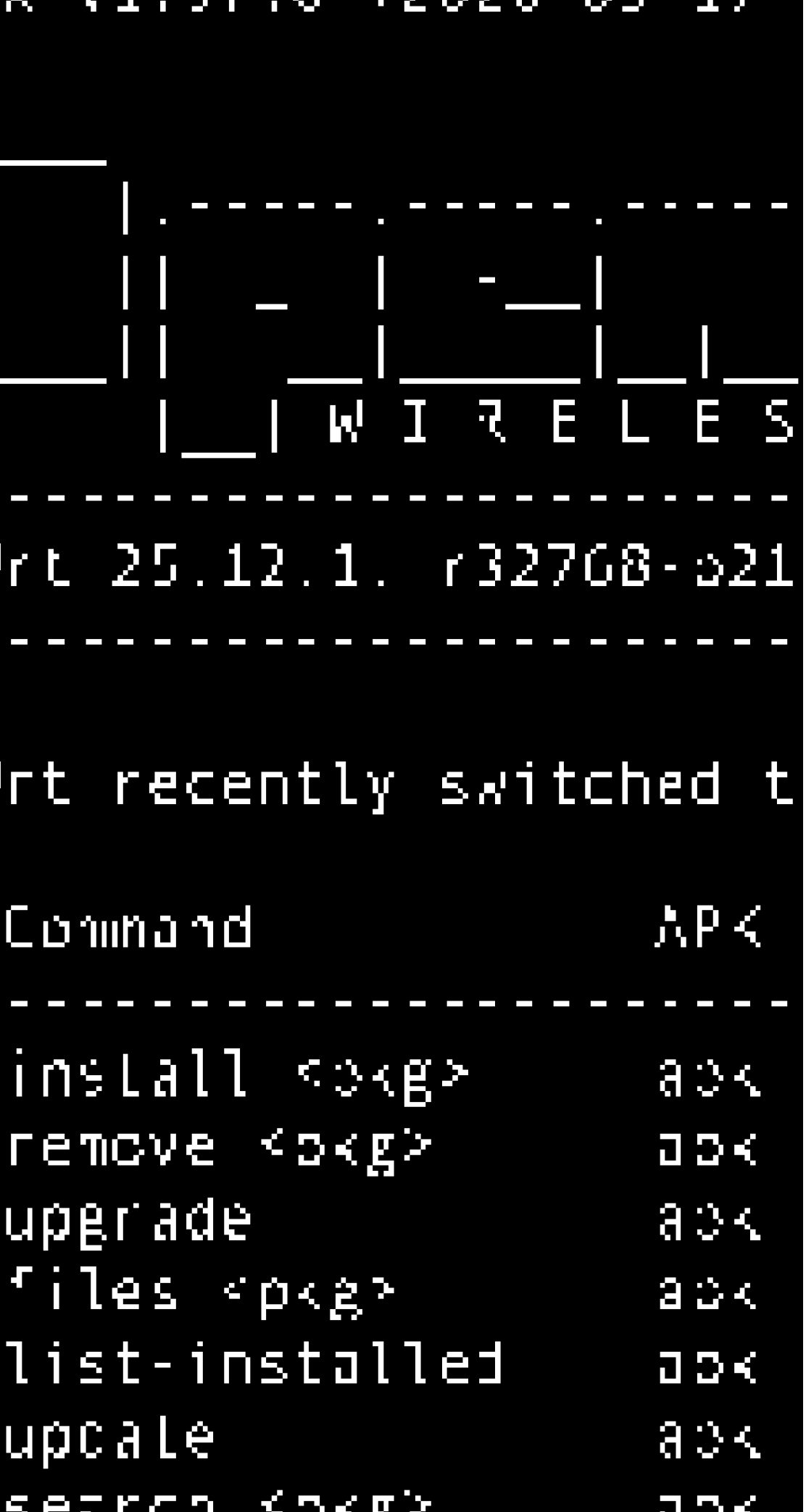
*Properties -> Internet Protocol Version 4 (TCP/IPv4).*[04]

Back in your browser, type *192.168.0.1* into the address bar and press enter. A login page should appear. If the router is new or has never been configured, try leaving both fields empty and pressing Enter. If that does not work, try typing "admin" in both the username and password fields.

Once logged in, you will see the original TP-Link firmware interface. It may look different depending on your device, but the structure is similar across models, in my case it had a very dated feel, reminiscent of early 2000s web design.

04 » Internet Protocol Version 4 (IPv4) is the system that assigns a numerical address to every device on a network, so that data knows where to go and where it comes from: without one, no information could be delivered to the right place. Every device connected to a network needs one of these addresses to communicate.

## Notes


W I R E L E S
rt 25.12.1. r32768-o21
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remove <o<g>
upgrade
files <p<g>
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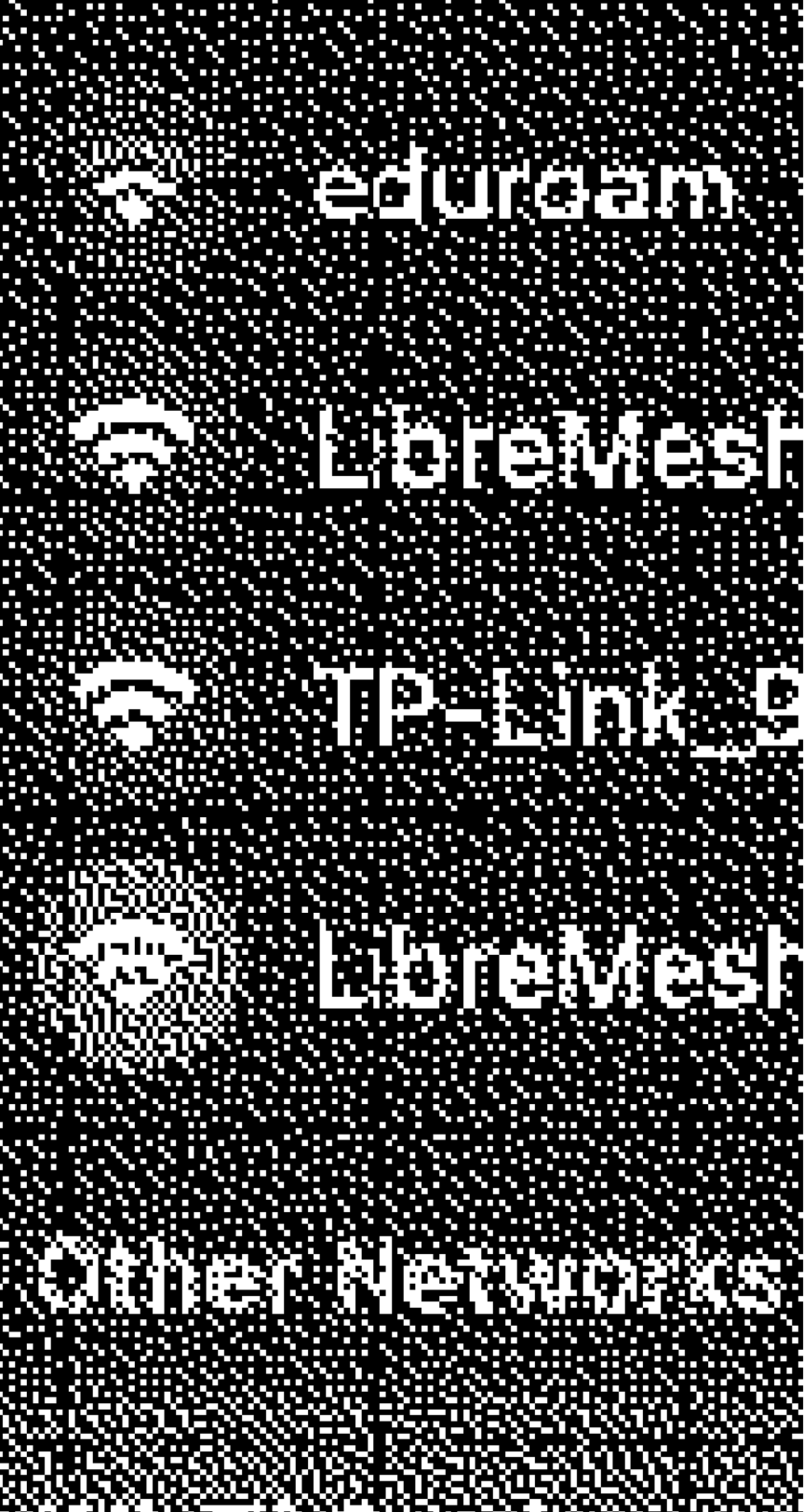
upcale




Task/
03

# Task/03

Download the OpenWrt firmware for your device from the firmware selector.

» Check the availability of OpenWrt for your device by going to *firmware-selector.openwrt.org* and typing the brand name, model, and version in the search bar.

» Note the exact name and the chosen configuration (even if you did not change them) of the file you downloaded in your flashing sheet.

» Note whether the download went smoothly or not. In both cases, update the flashing sheet with the steps you followed, including any errors you encountered and how you solved them.

# Guide

**Downloading the OpenWrt firmware**

On *firmware-selector.openwrt.org* type on the search bar the device brand, model and version. If the device is compatible, its name should appear on the research menu.

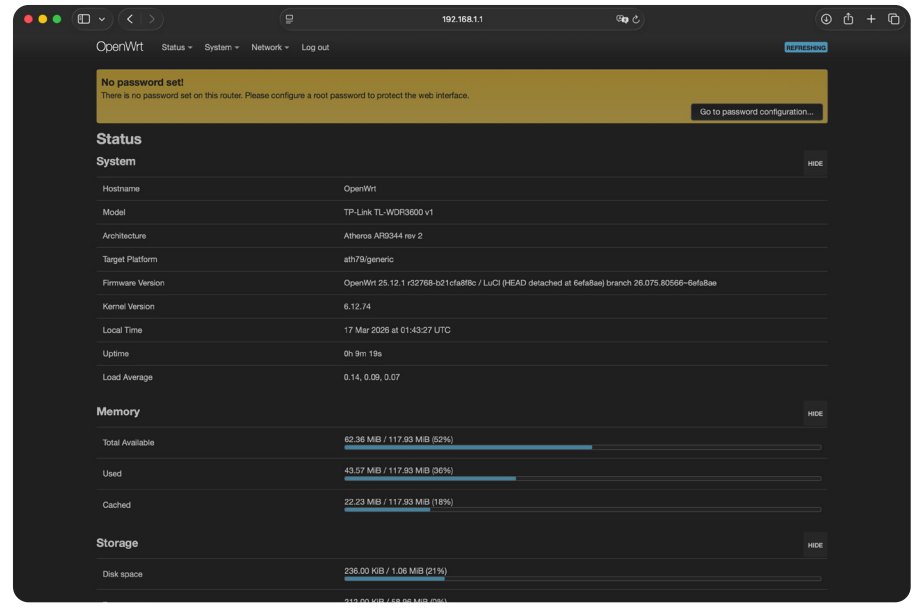
Once selected your device, procede further, scroll to the bottom of the interface and download the “factory” image[05]. Store the outcoming file.

05 » The term “image” refers to a file that contains a complete operating system and can be used to install it on a device. It is referred to as an “image” because it is a replica of the operating system and contains all the instructions required to execute the system. For example, when downloading a firmware image for a router, it will contain all the necessary software for the router to work with the updated software.

# Notes








browser while this is happening. Wait a couple of minutes before doing anything.

**Update Network Settings**

OpenWrt uses a different default address than the original TP-Link firmware, so we need to update our network settings to match. Go back to:

*System Settings -> Network*
*-> USB 10/100 LAN (or Ethernet)*

Click Details, and open the *TCP/IP* section.
Make sure Configure *IPv4* is still set to Manually, and update the values to the following:

*IP Address: 192.168.1.2*

*Subnet Mask: 255.255.255.0*

*Router: 192.168.1.1*

Click OK in the bottom right corner.

**Reach the Device**

Back in Safari, type *http://192.168.1.1* into the address bar. A new interface should appear: this is *OpenWrt*. If the browser asks whether you want to save a password, ignore it and press Enter. You are now inside your newly flashed device.

# Notes

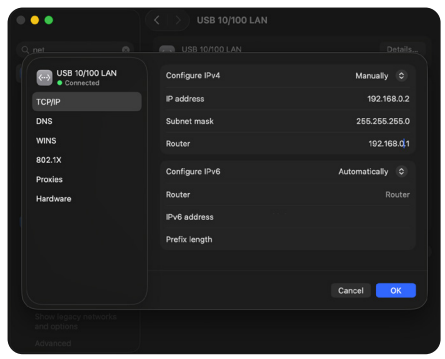
# Task/04

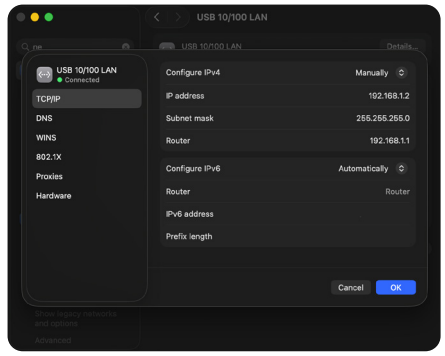
» Follow the steps below and document your process as you go. In the *Node Sheet*, note any form of error you encountered: be specific about what went wrong, how you fixed it, and which sources, tutorials, or people helped you find the solution. Errors and dead ends are as valuable as successes: they potentially are the most useful part of the docu mentation for anyone who will repeat this process after you.

» Describe if your access to the Open-wrt system went smoothly or not (extend on resolutive passages).

» Describe how the router's behaviour changed during the installation (lights, pop up windows etc).

## Guide




**Flashing OpenWrt**

Once logged in your device's firmware, navigate to System Tools in the left-hand menu, then select Firmware Upgrade.

*System Tools -> Firmware Upgrade*

This section was originally designed to let users install official TP-Link updates. We are going to use it for uploading the OpenWrt firmware we downloaded earlier, replacing the manufacturer's software with our own. Click Choose File, select the file you downloaded from the OpenWrt website, and click Upgrade.

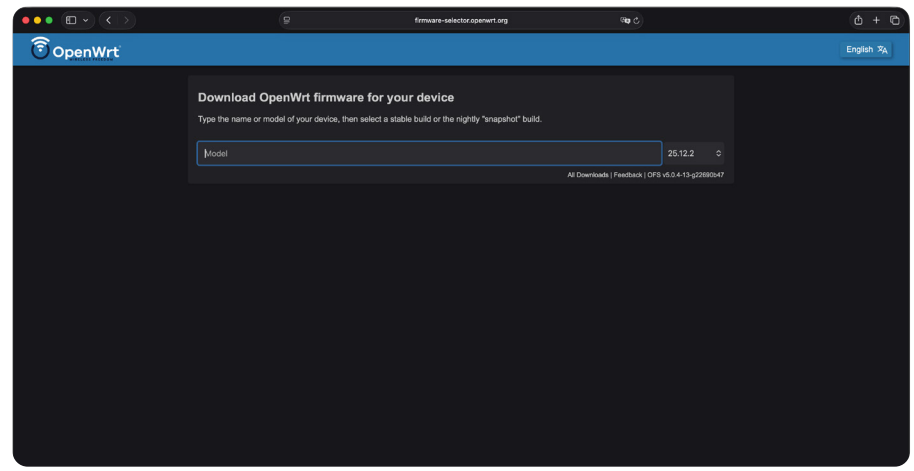
The filename of your downloaded file will vary depending on your device model what matters is that it ends in *-factory.bin*. If you get an error when trying to upload, the filename might be too long for the router to accept. This happened to me too: I fixed it by renaming the file to simply factory.bin before uploading, and it worked immediately.

Once the upload starts, a progress bar will appear. At some point the connection will drop and the page will stop loading entirely, this is supposed to happen. It means *OpenWrt* is installing and the router is switching to a new address. Do not unplug the router or close the

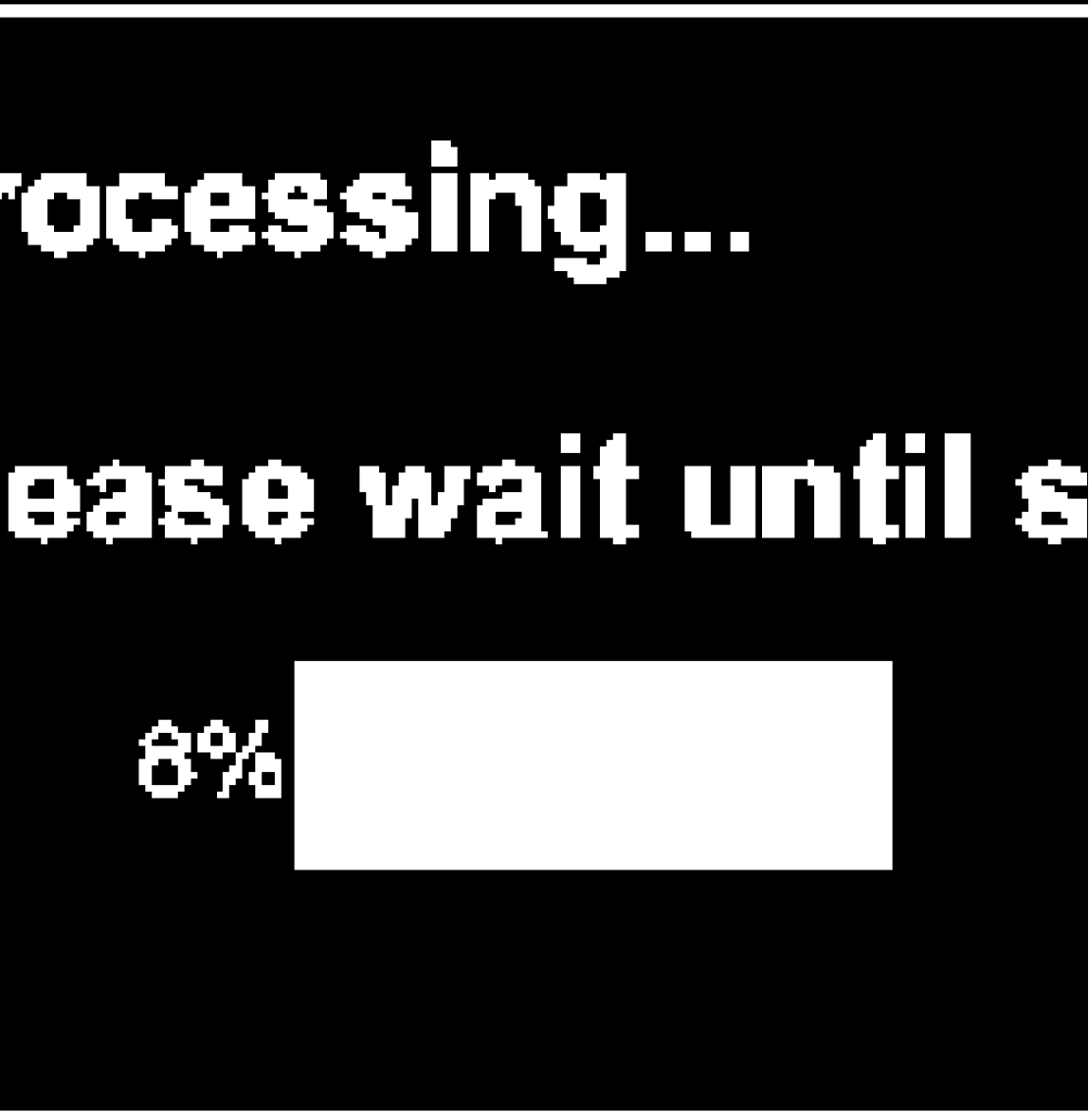
## Notes








## Notes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