

Operating System

The CM4 router board is compatible with most systems that support Raspberry Pi 4, but most Linux distributions do not optimize the network device scenarios. So OpenWRT and Raspberry Pi OS are recommended.

For Raspberry Pi OS

- If you are using Raspberry Pi OS.

1. Enable USB2.0 Port: After flash the latest image file to TF card and then modify /boot/config.txt file and add following line to the file.

```
dtoverlay=dwc2,dr mode=host
```

Save it and reboot Raspberry Pi.

2. Enable OLED onboard:

2.1 Enable I2C function, Open a terminal and typing:

```
sudo raspi-config
```

Navigate to `Interface Options` -> `I2C` -> `Enable` -> `YES`.

2.2 Download libraaries from github:

- Open a terminal and Download demo code from:

[https://github.com/adafruit/Adafruit_Python_SSD1306]

```
sudo python -m pip install --upgrade pip setuptools wheel
git clone https://github.com/adafruit/Adafruit_Python_SSD1306.git
cd Adafruit_Python_SSD1306
sudo python setup.py install
pip install Adafruit-BBIO
```

- Run example Demo:

```
cd examples/
python stats.py
```

For Using OpenWRT

- OpenWRT official snapshot version

The official snapshot is the smallest system, using serial terminal control, you need to manually install the Web console, driver, etc. it is recommended for experienced users.

OpenWRT official website: [<https://openwrt.org/>]

OpenWRT Develop Guide:
[<https://openwrt.org/docs/guide-developer/source-code/start>]

OpenWRT User Guide: [<https://openwrt.org/docs/guide-user/start>]

OpenWRT forum: [<https://openwrt.org/contact#forum>]

OpenWRT on Raspberry Pi CM4:
[https://openwrt.org/toh/hwdata/raspberry_pi_foundation/raspberry_pi_foundation_raspberry_pi_cm4]

OpenWRT Raspberry Pi Foundation:
[https://openwrt.org/toh/raspberry_pi_foundation/raspberry_pi]

OpenWRT Use BuildSystem:
[<https://openwrt.org/docs/guide-developer/build-system/use-buildsystem>]

OpenWRT Build-System:
[<https://openwrt.org/docs/guide-developer/build-system/install-buildsystem>]

SD Card Installation

Suitable for Compute Module 4 Lite without eMMC version.

1. Requirements

- Card Reader
- Etcher
- 7-Zip Compressed File Manager
- OS image file

Flash the image file to MicroSD card by using etcher imaging tool.

Build OpenWRT Customized Firmware

You can build your own firmware by building OpenWRT from source.

1.Prepare Compile Environment

Flash the latest version of Raspberry Pi OS to TF card(32GB recommended).

Modify /boot/config.txt file and adding the following parameter to enable the USB port function:

```
dtoverlay=dwc2,dr_mode=host
```

- Insert the microSD card or TF card into card slot on CM4 Router Board.
- Connect the power supply(5V/3A) on USB-C port.
- After booting up the system, please connect to internet and typing following command in a terminal:

```
sudo apt-get update  
sudo apt-get -y upgrade
```

- Install dependencies packages:

```
sudo apt-get -y install build-essential asciidoc binutils bzip2 libncurses5-dev flex  
git-core p7zip p7zip-full  
sudo apt-get -y install libssl-dev libelf-dev autoconf automake libtool  
device-tree-compiler gettext libi2c-dev  
sudo apt-get -y install libz-dev texinfo
```

- After installing, please reboot your Raspberry Pi CM4 by typing:

```
sudo sync && sudo reboot
```

- Create a folder and download OpenWRT source code by using git tool:

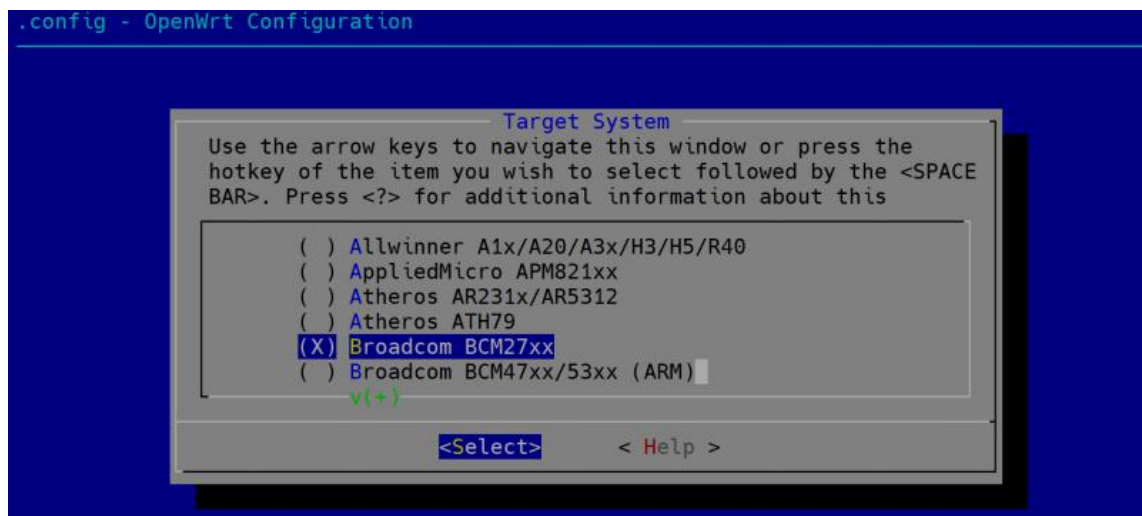
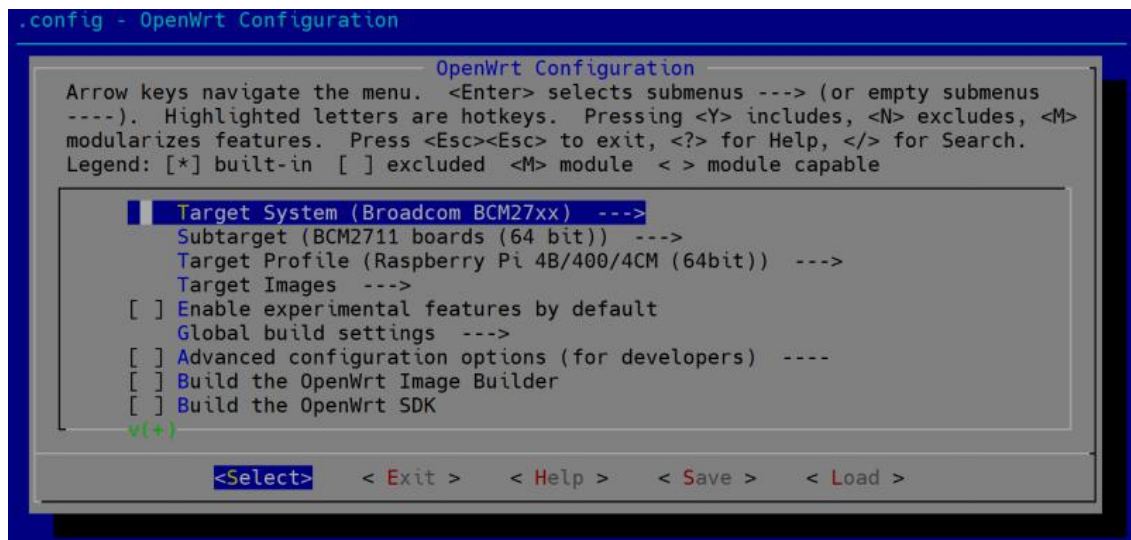
```
mkdir openwrt && cd openwrt  
git clone --depth=1 https://github.com/openwrt/openwrt  
cd openwrt/  
./scripts/feeds update -a
```

```
./scripts/feeds install -a
```

- Download 'luci-app-oled' libraries.

```
cd ~/openwrt/openwrt/package/feeds/luci/  
git clone https://github.com/NateLol/luci-app-oled.git  
cd ~/openwrt/openwrt/  
./scripts/feeds update -a  
./scripts/feeds install -a  
** Configure the compile options by typing:  
<pre> make menuconfig
```

And then select "Target System" and "Target Profile" as following picture:



Navigate to 'kernel modules' and select 'kmod-i2c-xxx' as following pictures:

```
.config - OpenWrt Configuration
                                OpenWrt Configuration
Arrow keys navigate the menu. <Enter> selects submenus --- (or empty submenus ----). Highlighted letters are hotkeys.
Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.
Legend: [*] built-in [ ] excluded <M> module <> module capable

[*] Enable experimental features by default (NEW)
Global build settings --->
[*] Advanced configuration options (for developers) (NEW) ----
[*] Build the OpenWrt Image Builder (NEW)
[*] Build the OpenWrt SDK (NEW)
[*] Package the OpenWrt-based Toolchain (NEW)
[*] Image configuration (NEW) --->
Base system --->
Administration --->
Root Loaders --->
Development --->
Extra packages --->
Firmware --->
Fonts --->
Kernel modules --->
Languages --->
Libraries --->
LuCI --->
Mail --->
Multimedia --->

<Select> < Exit > < Help > < Save > < Load >
```

```
.config - OpenWrt Configuration
> Kernel modules
                                Kernel modules
Arrow keys navigate the menu. <Enter> selects submenus --- (or empty submenus ----). Highlighted letters are hotkeys.
Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.
Legend: [*] built-in [ ] excluded <M> module <> module capable

Block Devices --->
CAN Support --->
Cryptographic API modules --->
Filesystems --->
FireWire support --->
Hardware Monitoring Support --->
I2C support --->
Industrial I/O Modules --->
Input modules --->
LED modules --->
Libraries --->
Native Language Support --->
Netfilter Extensions --->
Network Devices --->
Network Support --->
Other modules --->
PCMCIA support ----
SPI Support --->
Sound Support --->
USB Support --->

<Select> < Exit > < Help > < Save > < Load >
```

```
.config - OpenWrt Configuration
> Kernel modules > I2C support
                                I2C support
Arrow keys navigate the menu. <Enter> selects submenus --- (or empty submenus ----). Highlighted letters are hotkeys.
Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.
Legend: [*] built-in [ ] excluded <M> module <> module capable

-* kmod-i2c-algo-bit..... I2C bit-banging interfaces
<> kmod-i2c-algo-pca..... I2C PCA 9564 interfaces (NEW)
<> kmod-i2c-algo-pcf..... I2C PCF 8584 interfaces (NEW)
<> kmod-i2c-bcm2835..... Broadcom BCM2835 I2C master controller driver (NEW)
-* kmod-i2c-core..... I2C support
<> kmod-i2c-designware-pci..... Synopsys DesignWare PCI (NEW)
<> kmod-i2c-gpio..... GPIO-based bitbanging I2C
-* kmod-i2c-mux..... I2C bus multiplexing support
<> kmod-i2c-mux-gpio..... GPIO-based I2C mux/switches
<> kmod-i2c-mux-pca9541..... Philips PCA9541 I2C mux/switches
<> kmod-i2c-mux-pca954x..... Philips PCA954x I2C mux/switches (NEW)
<> kmod-i2c-pxa..... Intel PXA I2C bus driver (NEW)
<M> kmod-i2c-smbus..... SMBus-specific protocols helper
<> kmod-i2c-tiny-usb..... I2C Tiny USB adaptor (NEW)

<Select> < Exit > < Help > < Save > < Load >
```

And then navigate to 'USB Support' to add usb2 and usb3 support.

```
.config - OpenWrt Configuration
> Kernel modules > USB Support
                                USB Support
Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty submenu ----). Highlighted letters are hotkeys.
Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.
Legend: [*] built-in [ ] excluded <M> module <> module capable

<> kmod-chaoskey..... Chaoskey hardware RNG support (NEW)
<> kmod-usb-acm..... Support for modems/isdn controllers (NEW)
<> kmod-usb-atm..... Support for ATM on USB bus (NEW)
<> kmod-usb-cm109..... Support for CM109 device (NEW)
-* kmod-usb-core..... Support for USB
<M> kmod-usb-dwc2..... DWC2 USB controller driver
<M> kmod-usb-dwc3..... DWC3 USB controller driver
<> kmod-usb-gadget-cdc-composite..... USB CDC Composite (Ethernet + ACM) (NEW)
<> kmod-usb-gadget-ehci-debug..... USB EHCI debug port Gadget support (NEW)
<> kmod-usb-gadget-eth..... USB Ethernet Gadget support (NEW)
<> kmod-usb-gadget-hid..... USB HID Gadget Support (NEW)
<> kmod-usb-gadget-mass-storage..... USB Mass Storage support (NEW)
<> kmod-usb-gadget-ncm..... USB Network Control Model (NCM) Gadget support (NEW)
<> kmod-usb-gadget-serial..... USB Serial Gadget support (NEW)
<M> kmod-usb-hid..... Support for USB Human Input Devices (NEW)
<> kmod-usb-hid-cp2112..... Silicon Labs CP2112 HID USB to SMBus Master Bridge
<> kmod-usb-ledtrig-usbport..... LED trigger for USB ports (NEW)
[*] kmod-usb-net..... Kernel modules for USB-to-Ethernet converters
<> kmod-usb-net-aqc111..... Support for USB-to-Ethernet Aquantia AQtion 5/2, 5GbE (NEW)
<> kmod-usb-net-asix..... Kernel module for USB-to-Ethernet Asix converters (NEW)
v1+

<Select> < Exit > < Help > < Save > < Load >
```

```
.config - OpenWrt Configuration
> Kernel modules > USB Support
                                USB Support
Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty submenu ----). Highlighted letters are hotkeys.
Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.
Legend: [*] built-in [ ] excluded <M> module <> module capable

[*] kmod-usb-serial-oti6858..... Support for Durs Technology OTI6858 devices (NEW)
<> kmod-usb-serial-pl2303..... Support for Prolific PL2303 devices (NEW)
<> kmod-usb-serial-qualcomm..... Support for Qualcomm USB serial (NEW)
<> kmod-usb-serial-sierrawireless..... Support for Sierra Wireless devices (NEW)
<> kmod-usb-serial-simple..... USB Serial Simple (Motorola phone) (NEW)
<> kmod-usb-serial-ti-usb..... Support for TI USB 3418/5052 (NEW)
<> kmod-usb-serial-visor..... Support for Handspring Visor devices (NEW)
<> kmod-usb-storage..... USB Storage support (NEW)
<> kmod-usb-storage-extras..... Extra drivers for usb-storage (NEW)
<> kmod-usb-storage-uas..... USB Attached SCSI (UASP) support (NEW)
<> kmod-usb-uhcd..... Support for UHCI controllers (NEW)
<> kmod-usb-wdm..... USB Wireless Device Management (NEW)
<> kmod-usb-yealink..... USB Yealink VOIP phone (NEW)
<M> kmod-usb2..... Support for USB2 controllers
<M> kmod-usb2-pci..... Support for PCI USB2 controllers (NEW)
[*] kmod-usb3..... Support for USB3 controllers
<> kmod-usbip..... USB-over-IP kernel support (NEW)
<> kmod-usbip-client..... USB-over-IP client driver (NEW)
<> kmod-usbip-server..... USB-over-IP host driver (NEW)
<> kmod-usbmon..... USB traffic monitor (NEW)

<Select> < Exit > < Help > < Save > < Load >
```

And then select 'coreutils' in 'Utilites' menu.

```
.config - OpenWrt Configuration
                                OpenWrt Configuration
Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty submenu ----). Highlighted letters are hotkeys.
Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.
Legend: [*] built-in [ ] excluded <M> module <> module capable

[*] Build the OpenWrt SDK (NEW)
[*] Package the OpenWrt-based Toolchain (NEW)
[*] Image configuration (NEW) --->
Base system --->
Administration --->
Boot Loaders --->
Development --->
Extra packages --->
Firmware --->
Fonts --->
Kernel modules --->
Languages --->
Libraries --->
LuCI --->
Mail --->
Multimedia --->
Network --->
Sound --->
[*] Utilities --->
Xorg --->

<Select> < Exit > < Help > < Save > < Load >
```

```

.config - OpenWrt Configuration
> Utilities
Utilities
Arrow keys navigate the menu. <Enter> selects submenus --- (or empty submenu ----). Highlighted letters are hotkeys.
Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.
Legend: [*] built-in [ ] excluded <M> module <> module capable

< > chkcon..... libsepol chkcon security context validation tool (NEW)
< > clocate..... Determine device location using neighbouring WiFi networks (NEW)
< > cmdpad..... execute commands when key is pressed/released/held down (NEW)
< > cni..... cni (NEW)
< > cni-plugins..... cni-plugins (NEW)
< > cni-plugins-nft..... CNI Plugins compatible with nftables (NEW)
< > coap-client..... CoAP (RFC 7252) client tool (NEW)
< > collectd..... Lightweight system statistics collection daemon (NEW) ----
< > common..... Podman common (NEW)
< > containerd..... containerd container runtime (NEW) ----
< > coremark..... CoreMark Embedded Microprocessor Benchmark (NEW)
< > coreutils..... The GNU core utilities ---
< > crconf..... Linux crypto layer configuration tool (NEW)
< > crelay..... USB relay remote control daemon (NEW)
< > crun..... crun (NEW)
< > csstidy..... CSSTidy parser and optimiser (NEW)
< > ct-bugcheck..... Bug checking and reporting utility (NEW)
< > ctop..... Top-like interface for container metrics (NEW)
< > dbus..... Simple interprocess messaging system (daemon) (NEW)
< > dbus-utils..... Simple interprocess messaging system (utilities) (NEW)
v(+)

<Select> < Exit > < Help > < Save > < Load >

```

and enable 'libi2c' in 'libraries' menu.

```

.config - OpenWrt Configuration
OpenWrt Configuration
Arrow keys navigate the menu. <Enter> selects submenus --- (or empty submenu ----). Highlighted letters are hotkeys.
Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.
Legend: [*] built-in [ ] excluded <M> module <> module capable

[*] Build the OpenWrt SDK (NEW)
[*] Package the OpenWrt-based Toolchain (NEW)
[*] Image configuration (NEW) ---
Base system ---
Administration ---
Boot Loaders ---
Development ---
Extra packages ---
Firmware ---
Fonts ---
Kernel modules ---
Languages ---
Libraries ---
LuCI ---
Mail ---
Multimedia ---
Network ---
Sound ---
Utilities ---
Xorg ---

<Select> < Exit > < Help > < Save > < Load >

```

```

.config - OpenWrt Configuration
> Libraries
Libraries
Arrow keys navigate the menu. <Enter> selects submenus --- (or empty submenu ----). Highlighted letters are hotkeys.
Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.
Legend: [*] built-in [ ] excluded <M> module <> module capable

< > libgmp..... GNU multiprecision arithmetic library (NEW)
< > libgnurl..... A client-side HTTP/HTTPS transfer library (NEW)
< > libgpg-error..... GnuPG error handling helper library (NEW)
< > libgpgme..... GnuPG Made Easy (GPGME) library (NEW)
< > libgpgmepp..... GnuPG Made Easy (GPGME) library (C++) (NEW)
< > libgphoto2..... The basic library of the gphoto2 program, version 2.5.26. (NEW) ----
< > libgpod..... Library for interacting with Linux's GPIO character device
< > libgps..... C service library for communicating with the GPS daemon (NEW)
< > libh2o..... H2O Library compiled with libuv (NEW)
< > libh2o-evloop..... H2O Library compiled with its own event loop (NEW)
< > libhamlib..... Ham Radio Control shared library (NEW) ----
< > libhavege..... Library for haveged (NEW)
< > libhiredis..... Minimalistic C client for Redis (NEW)
< > libhttp-parser..... A library to parse http request and response (NEW)
< > libhwloc..... Portable Hardware Locality libraries (NEW)
< > libi2c..... I2C library for i2c-tools
< > libical..... An implementation of iCalendar protocols and data formats (NEW)
< > libiconv (NEW)
< > libiconv-full..... Character set conversion library (NEW)
< > libid3tag..... An ID3 tag manipulation library (NEW)
v(+)

<Select> < Exit > < Help > < Save > < Load >

```

Next step is to enable LuCI `Collections` and `applications`.

```
.config - OpenWrt Configuration
OpenWrt Configuration
Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty submenu ----). Highlighted letters are hotkeys.
Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.
Legend: [*] built-in [ ] excluded <M> module <> module capable

[*] Build the OpenWrt SDK (NEW)
[ ] Package the OpenWrt-based Toolchain (NEW)
[ ] Image configuration (NEW) --->
Base system --->
Administration --->
Boot Loaders --->
Development --->
Extra packages --->
Firmware --->
Fonts --->
Kernel modules --->
Languages --->
Libraries --->
LuCI --->
Mail --->
Multimedia --->
Network --->
Sound --->
Utilities --->
Xorg --->

<Select> < Exit > < Help > < Save > < Load >
```

```
.config - OpenWrt Configuration
> LuCI
LuCI
Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty submenu ----). Highlighted letters are hotkeys.
Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.
Legend: [*] built-in [ ] excluded <M> module <> module capable

1. Collections --->
2. Modules --->
3. Applications --->
4. Themes --->
5. Protocols --->
6. Libraries --->

<Select> < Exit > < Help > < Save > < Load >
```

```
.config - OpenWrt Configuration
> LuCI > 1. Collections
1. Collections
Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty submenu ----). Highlighted letters are hotkeys.
Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.
Legend: [*] built-in [ ] excluded <M> module <> module capable

-*> luci..... LuCI interface with Uhttpd as Webserver (default)
<> luci-lib-docker..... LuCI library for docker (NEW)
<> luci-nginx..... LuCI interface with Nginx as Webserver (NEW)
<> luci-ssl..... LuCI with HTTPS support (WolfSSL as SSL backend) (NEW)
<> luci-ssl-nginx. LuCI with HTTPS support on Nginx (OpenSSL as SSL backend) (NEW)
<M> luci-ssl-openssl..... LuCI with HTTPS support (OpenSSL as SSL backend)

<Select> < Exit > < Help > < Save > < Load >
```

Navigate to `Applications` -> `luci-app-oled` and check it:


```
.config - OpenWrt Configuration
> LuCI > 3. Applications
3. Applications
Arrow keys navigate the menu. <Enter> selects submenus --- (or empty submenus ----). Highlighted letters are hotkeys.
Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.
Legend: [*] built-in [ ] excluded <M> module <> module capable

<> luci-app-hnet..... HNCP Homenet configuration and visualization (NEW)
<> luci-app-https-dns-proxy..... DNS Over HTTPS Proxy Web UI (NEW)
<> luci-app-ksmbd..... Network Shares - Ksmbd the SMB kernel fileserver (NEW)
<> luci-app-ledtrig-rssi..... LuCI Support for ledtrigger rssi (NEW)
<> luci-app-ledtrig-switch..... LuCI Support for ledtrigger switch (NEW)
<> luci-app-ledtrig-usbport..... LuCI Support for ledtrigger usbport (NEW)
<> luci-app-lxc..... LXC management Web UI (NEW)
<> luci-app-minidlna..... LuCI Support for minIDLNA (NEW)
<> luci-app-mjpg-streamer..... MJPG-Streamer service configuration module (NEW)
<> luci-app-mwan3..... LuCI support for the MWAN3 MultiWAN Manager (NEW)
<> luci-app-nextdns..... LuCI support for NextDNS (NEW)
<> luci-app-nft-qos..... QoS over Nftables (NEW)
<> luci-app-nlbwmon..... Netlink based bandwidth accounting (NEW)
<> luci-app-ntp..... NTP time synchronisation configuration module (NEW)
<> luci-app-nut..... Network UPS Tools Configuration (NEW)
<> luci-app-ocserv..... LuCI Support for OpenConnect VPN (NEW)
[*] > luci-app-oled..... LuCI luci-app-oled app
<> luci-app-olsr..... OLSR configuration and status module (NEW)
<> luci-app-olsr-services (NEW)
<> luci-app-olsr-viz..... OLSR Visualisation (NEW)

<Select> < Exit > < Help > < Save > < Load >
```

Save the configuration to `.config` file

```
.config - OpenWrt Configuration

Do you wish to save your new configuration?
(Press <ESC><ESC> to continue kernel configuration.)

< Yes > < No >
```

- Compile it with following command:

```
make V=s -j1
```

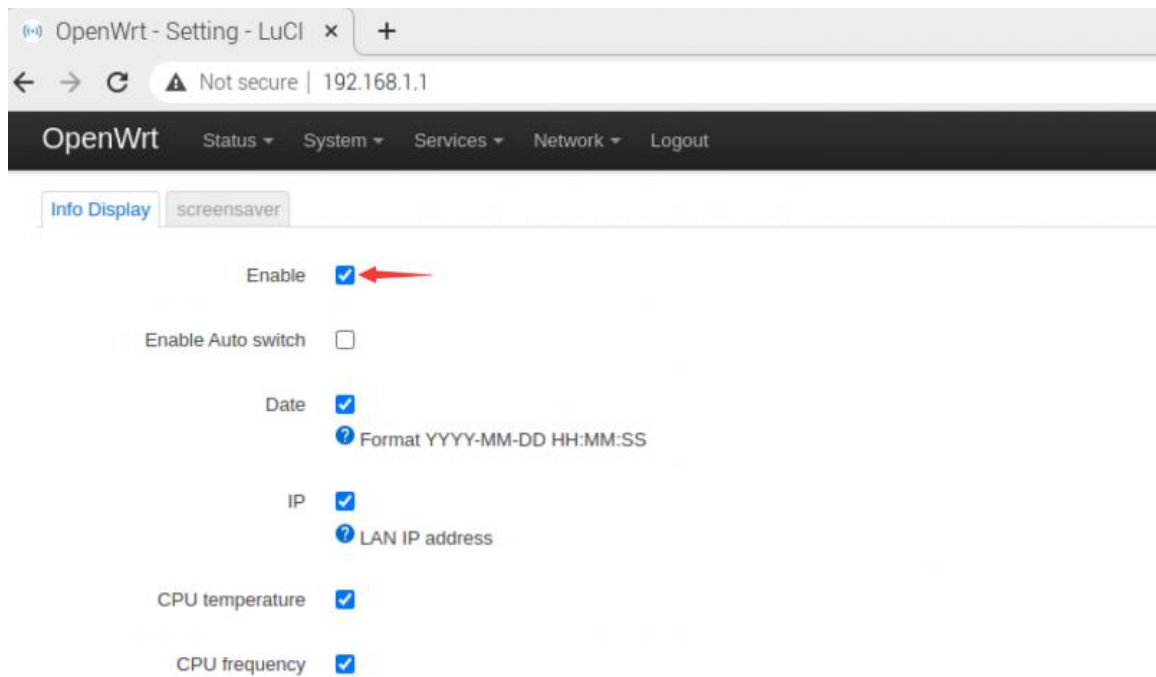
It may take a while, grab a cup of coffee.

- Firmware will be generated on location:

```
~/openwrt/openwrt/bin/targets/bcm27xx/
```

- Factory image file: `openwrt-bcm27xx-bcm2711-rpi-4-ext4-factory.img.gz` or `openwrt-bcm27xx-bcm2711-rpi-4-squashfs-factory.img.gz`

- Login to LuCI interface via browser and enable it, and then you can find the OLED in `service` tab, you can configure it as the notifications.



- Check the checkbox on `enable` and click `save it and apply`.