

Installing OpenWRT on a Raspberry Pi as a New Home Firewall

by Ben Miller 8 Nov 2013

[OpenWRT](#) is an active and vibrant home firewall project that was born on the Linksys WRT54G line of home routers. It has grown and expanded to support an amazing array of old and new hardware alike. The list of compatible hardware is large enough to require its own [index](#).

With the recent interest in the Raspberry Pi there is of course is an OpenWRT build for it as well. In this tutorial I will show you how to install OpenWRT on a Raspberry Pi, add a second network interface, and replace your home firewall with your new OpenWRT firewall.

OpenWRT

Of course, a Raspberry Pi could be used as a firewall with the default Raspbian distribution with the right configuration, packages, and tweaks. The key value of OpenWRT, however, is that it provides an easy to use and manage firewall solution for those who are not linux power users. Most common operations can be done through the friendly web interface.

Please note that the OpenWRT image for the Raspberry Pi is very new and still under development. This tutorial uses a modified version of the default image to fix boot issues and SD Card stability. Refer to this article [about the modifications](#) for an in-depth explanation. I'll be using the pre-built, modified image so no custom compiling or advanced knowledge is required.

Gather the Components

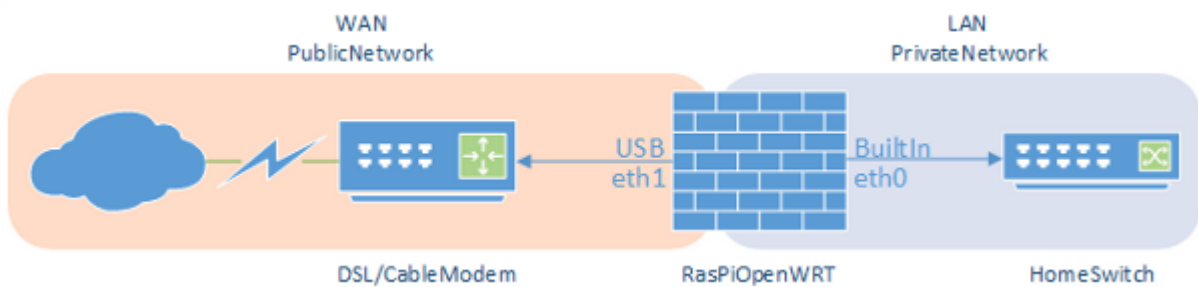
- Raspberry Pi Model B. Check out the [Raspberry Pi Buyer's Guide](#) for buying options
- [Power adapter](#)
- [SD Card](#)
- PI Case
- [INTELLINET Hi-Speed USB 2.0](#)
- Ethernet cable connected to home network
- Ethernet cable to connect to Internet Interface (Cable Modem/DSL Modem/etc)
- HDMI monitor - setup only

- USB Keyboard - setup only
- Computer for SD Card image creation and configuration - setup only

Tip: When purchasing components for use with your RasPi elinux.org has a list of [verified peripherals](#).

The instructions below assume that you have access to an existing private network to download and setup the firewall. In my case, I built my OpenWRT RasPi firewall behind my old firewall before replacing it. I'm going to use my process as the model for this tutorial. Additionally, this tutorial assumes you have a separate switch for your network that is not integrated with your home router.

This diagram shows how the networking is going to be configured in the finished product. The OpenWRT will replace a standard two interface firewall. This tutorial will not cover adding WAP functionality to the firewall, although that may be a future topic.



Network Diagram

Gather Information

You will need some basic information about your network. Write down your internal IP address space information for later use. In this example I will use the network 192.168.1.0, netmask 255.255.255.0, and broadcast 192.168.1.255 as this is a very common home setup.

Write down the IP address of your current firewall. In this example it is 192.168.1.1. Finally, find an unused IP address to use temporarily in this process. I'll use 192.168.1.2 in my example.

Most of this information can be discovered by interrogating your existing firewall.

Assemble the Raspberry Pi

- Put the RasPi in it's case
- Attach the monitor and USB Keyboard
- Plug in the USB Network card - don't attach a cable

- Plug in a network cable from your home network to the RasPi's built in network interface
 - Get the power ready to plug in but do not attach it yet
-

Create Boot SD Card

- Download the modified [OpenWRT image](#)
- Uncompress the bz2 image (use bunzip2 for Linux or OSX and [7zip](#) for Windows)
- Write the extracted image to the SD Card using the methods described in the tutorial [How to Flash an SD Card for Raspberry Pi](#)
- Insert the SD card into your RasPi
- Attach power

OpenWRT has official versions for the Raspberry Pi now, so I recommend everyone fetch the latest one rather than using the 2 year old custom image linked in this article.

At this point your should see typical boot messages scroll on you monitor.

Boot the Pi and Change the Default Password

Once the console has stopped scrolling messages hit the enter key to open the command line prompt. You will see something like this:

```

|-----|-----|-----|-----|-----|-----|-----|-----|
|   -   |   -   |   -   |   -   |   -   |   -   |   -   |   -   |
|-----|-----|-----|-----|-----|-----|-----|-----|
|   | W I R E L E S S   F R E E D O M   |
|-----|-----|-----|-----|-----|-----|-----|-----|
ATTITUDE ADJUSTMENT (12.09-rcl, r34185)
-----
* 1/4 oz Vodka      Pour all ingredients into mixing
* 1/4 oz Gin        tin with ice, strain into glass.
* 1/4 oz Amaretto
* 1/4 oz Triple sec
* 1/4 oz Peach schnapps
* 1/4 oz Sour mix
* 1 splash Cranberry juice
-----
root@OpenWrt:~# █

```

OpenWRT Issue

Making the *Attitude Adjustment* drink is optional and not required for this tutorial. It may be fun however if you have the ingredients on hand. If you choose to follow the instructions, ensure to pick back up here afterwards.

- Enter the command `ifconfig eth0` and you should see something like this:

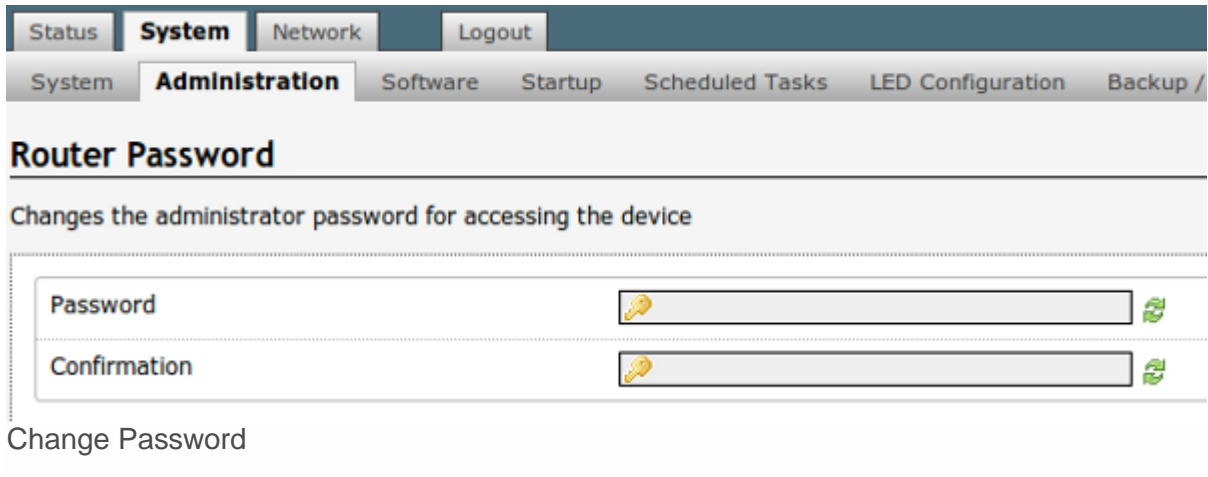
```

eth0 Link encap:Ethernet HWaddr B8:27:EB:5C:B3:3F
1  inet addr:192.168.1.126 Bcast:192.168.1.255 Mask:255.255.255.0
2
3  UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
4  RX packets:67533 errors:0 dropped:0 overruns:0 frame:0
5  TX packets:71487 errors:0 dropped:0 overruns:0 carrier:0
6
7  collisions:0 txqueuelen:1000
   RX bytes:24032301 (22.9 MiB) TX bytes:12706941 (12.1 MiB)

```

Pay attention to the *inet addr* line, above. This is the current IP address the system received by DHCP. You will need this address to login and manage the device. In this example the IP is `192.168.1.126`.

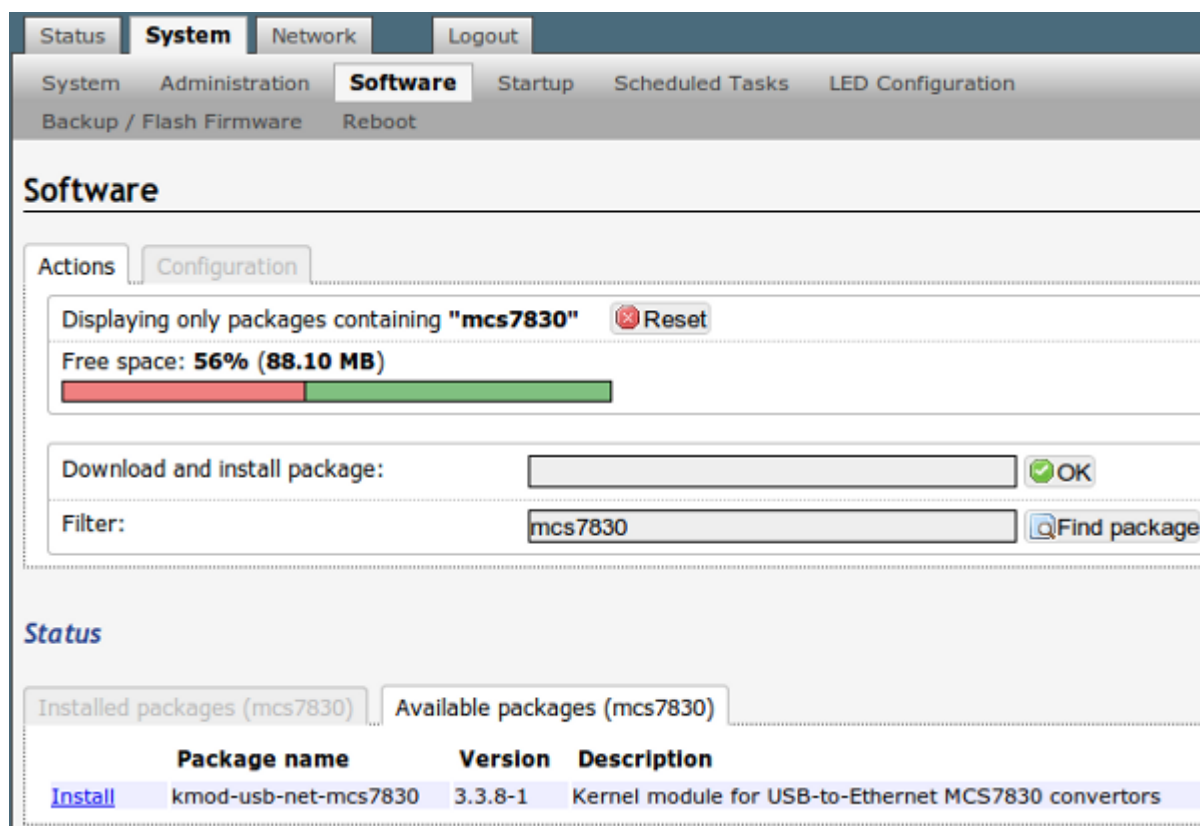
- Open a web browser to the IP address you identified above. You will see a warning that that the password has not been set. Click the link to set it.
- Enter `root` as the username and click the **login** button to login first without a password
- Enter a password into the **Password** and **Confirmation** fields
- Click **Save & Apply**



Install the Drivers for the USB Ethernet Adapter

The next step is to download and install the kernel drivers for the USB Ethernet adapter. OpenWRT has a nice web based package manager that will allow you to filter on an appropriate package and install or remove it as needed.

- Click on the **System > Software** tab
- Click the Update lists button to update the available package list
- Type **mcs7830** in the **Find Package** field
- Click **Find Package**
- Click the Available Packages tab below the filter field
- Click **Install** next to the `kmod-usb-net-mcs7830` package



The screenshot shows the OpenWRT web interface. The top navigation bar includes 'Status', 'System', 'Network', and 'Logout'. Below this, there are sub-menus for 'System', 'Administration', 'Software', 'Startup', 'Scheduled Tasks', and 'LED Configuration'. The 'Software' menu is active, and the 'Software' page is displayed. The page has two tabs: 'Actions' and 'Configuration'. The 'Configuration' tab is selected, showing a search filter for 'mcs7830' and a 'Reset' button. Below the search bar, there is a progress bar indicating 'Free space: 56% (88.10 MB)'. There are two input fields: 'Download and install package:' with an 'OK' button, and 'Filter:' with 'mcs7830' and a 'Find package' button. The 'Status' section shows two tabs: 'Installed packages (mcs7830)' and 'Available packages (mcs7830)'. The 'Available packages' tab is active, displaying a table with the following data:

	Package name	Version	Description
Install	kmod-usb-net-mcs7830	3.3.8-1	Kernel module for USB-to-Ethernet MCS7830 convertors

Install Kernel Module

Create the WAN Interface

The new USB network interface eth1 will be the external or WAN interface for the router. I recommend this particular adapter because it is a true USB 2.0 device and is not limited to the lower speeds of a 1.0 or 1.1 USB device. These next step will define the eth1 device as the WAN interface which OpenWRT understands and will automatically apply the correct firewall policy.

- Click on the **Network > Interfaces** tab
- Click **Add new interface**
- Enter as the interface name
- Select **eth1** from the list of available physical interfaces
- Select **DHCP** for as the Protocol
- Click the **Firewall Settings** tab and select **Wan** for the firewall zone
- Click **Save & Apply**

The screenshot shows the OpenWRT web interface for managing network interfaces. At the top, there are tabs for 'Status', 'System', 'Network', and 'Logout'. Below these are sub-tabs for 'Interfaces', 'DHCP and DNS', 'Hostnames', 'Static Routes', 'Firewall', and 'Diagnostics'. The main heading is 'Interfaces'. Underneath, there's a section titled 'Interface Overview' which contains a table with two rows: 'LAN' and 'WAN'. Each row shows the interface name, its status (green for LAN, red for WAN), uptime, MAC address, RX/TX statistics, and IPv4 address. To the right of each interface row are three buttons: 'Connect', 'Stop', and 'Edit'. At the bottom of the overview section, there is a button labeled 'Add new interface...'. Below the screenshot, the text 'OpenWRT Interfaces' is displayed.

Prepare to Cut Over to the Pi

Next, configure the internal interface to be static and enable the DNS/DHCP services on the internal network to allow internal dynamic IP addressing and name services. The temporary IP address is used in these steps to allow us to change the protocol to static, enable the DHCP services, and reconnect to the OpenWRT firewall later without jumping through too many hoops or having to statically assign an IP to your computer later in the process.

- Click on the **Network > Interfaces** tab
- Click **Edit** next to the eth0 LAN interface
- Change the protocol to **Static address**
- Confirm that you wish to change the protocol
- Enter the unused address you collected earlier into the IPv4 Address field. In this example: `192.168.1.2`
- Enter your subnet mask, most likely `255.255.255.0` in the IPv4 netmask field.
- Enter the broadcast address collected earlier in the IPv4 broadcast field. For example `192.168.1.255`
- Click **Save & Apply** - The results will not return to your browser because you just moved the Pi to a different address.
- Give the Pi a few minutes to commit the changes.
- Put the new IP address in your browser and connect to the Pi again.
- Click on the **System > Reboot** tab
- Click on the **Perform Reboot** link and confirm
- Log in when the system has rebooted

Confirm That Firewall and DHCP/DNS Services Are Set for Startup

- Click on the **System > Startup** tab
- Ensure that all services are enabled.
- Click on the red **X** next to a service if it is disabled to enable it. network, dnsmasq and firewall are of particular importance to have running.

System Administration Software Startup Scheduled Tasks LED Configuration
Backup / Flash Firmware Reboot

Initscripts

You can enable or disable installed init scripts here. Changes will applied after a device reboot.
Warning: If you disable essential init scripts like "network", your device might become inaccessible!

Start priority	Initscript	Enable/Disable	Start	Restart	Stop
5	luci_fixtime	Enabled	Start	Restart	Stop
10	boot	Enabled	Start	Restart	Stop
11	ubus	Enabled	Start	Restart	Stop
20	network	Enabled	Start	Restart	Stop
39	usb	Enabled	Start	Restart	Stop
45	firewall	Enabled	Start	Restart	Stop
50	cron	Enabled	Start	Restart	Stop
50	dropbear	Enabled	Start	Restart	Stop
50	telnet	Enabled	Start	Restart	Stop
50	uhttpd	Enabled	Start	Restart	Stop
59	luci_dhcp_migrate	Enabled	Start	Restart	Stop
60	dnsmasq	Enabled	Start	Restart	Stop
90	hwclock	Enabled	Start	Restart	Stop
95	done	Enabled	Start	Restart	Stop
96	led	Enabled	Start	Restart	Stop
97	watchdog	Enabled	Start	Restart	Stop
98	sysnptd	Enabled	Start	Restart	Stop
99	sysctl	Enabled	Start	Restart	Stop

All Services Set to Startup

Replace Existing Firewall

- Turn off your existing firewall
- Put the Raspberry Pi in place
- Plug the Internet/Modem facing cable into the USB interface
- Plug the LAN cable from your home network switch into the on-board interface
- Turn on the Raspberry Pi

Tip: If you don't leave a keyboard and monitor attached to your firewall it will still continue to work just fine. You can reconnect the monitor and keyboard if you need to troubleshoot or connect to the firewall via its serial interface (Instructions can be found at the [elinux.org RPi Serial Connection](http://elinux.org/RPi_Serial_Connection) page). Most online troubleshooting can be done by logging into the Pi via SSH. A monitor and keyboard may only be needed if it does not appear on the network.

Reconfigure the Internal Interface

This final reconfiguration of the interface will move it over to the address the old firewall was using. This will allow any existing DHCP leases or hard coded addresses in your home to continue using the Internet without interruption.

- Login to the temporary IP address 192.168.1.2
- Click on the Network>Interfaces tab
- Click Edit next to the LAN interface
- Change the IPv4 Address to be the address of your previous firewall. Example: 192.168.1.1
- Click Save & Apply - Again the task will not complete in the browser as you have changed the address of the Firewall
- Login to the OpenWRT Raspberry Pi at its new address you assigned i.e. 192.168.1.1

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Perform Final Reboot and Test

On rare occasions I discovered that the system needed a reboot to align all the rules and services after moving interfaces around. This last reboot is more to verify that everything is setup right from cold boot. This means next time the power goes out you'll still be in good shape after it comes back on.

- Click on the **System > Reboot** tab
- Click on the **Perform Reboot** link and confirm
- Wait approximately 60 seconds for the firewall to boot
- Test that your workstation has indeed getting a new DHCP address and can surf the Internet

Congratulations! You have a brand new firewall. Another *Attitude Adjustment* drink is optional.

Summary

In this tutorial I have installed OpenWRT onto a Raspberry Pi, added a second USB network interface, and replaced your home firewall. The simple web interface of OpenWRT provides a powerful and easy way to manage your new firewall. This default install provides basic home firewall functionality including Address Masquerading, DHCP, and DNS services.

These capabilities are just the beginning. There is a rich catalogue of software available for the openWRT that can be accessed via the **System > Software** tab. Packages exist to provide VPN, Web server, and many other features well beyond the capabilities of off the shelf home firewalls.

OpenWRT has official versions for the Raspberry Pi now, so I recommend everyone fetch the latest one rather than using the 2 year old custom image linked in this article.

Comments

INTJ • 9 months ago

The OpenWRT image download link you are referring is so slow. I still managed to download it and I wrote it in a sdcard. But Raspberry Pi didn't boot. I wonder what happened. I couldn't figure out what went wrong. Would be nice if you made this image file available from another place. I would try it again. Thank you.

Riad • 3 months ago

Hello all,

I have a question, i'm french and i want know how to plug my raspi into my "LaBox" by Numericable with USB cable. How to force my "LaBox" to redirect the flux "WAN" in his USB port ??.

Thanx a lot for your answer(s) !

Riad.

Abdul Hakam • 6 months ago

I need a video on how to make a firewall with raspberry for the final project .. step by step, because i don't understand...

UnaClocker • 11 days ago

Thanks for posting this. Worked excellent for me. Worth noting, **OpenWRT has official versions for the Raspberry Pi now, so I recommend everyone fetch the latest one rather than using the 2 year old custom image linked in this article.**

hoatienii • 2 months ago

can add wifi adapter on raspberry run openwrt

TRE • 3 months ago

Hi, thank you for your Image - I downloaded the file and flashed the sd as usual. The issue is that nothing happens at the pi - the system isn't booting at all. There is the red led burning and for a short moment the green one - then just a black screen and nothing happens. I tried different SD Cards. Please help me!! Thank you

Baylink • 3 months ago

A step you should add:

When unplugging the old router, and plugging the Pi into your DSL or cablemodem, power cycle the modem. Most DSL connections, and nearly all cablemodems I know about, still MAC-lock their LAN interface; the first MAC it sees is the only device it will ever talk to until a power cycle.

Helen Fornazier • 4 months ago

Hi Ben, Thanks for this post.

I am trying to use your image of OpenWRT, but when I get the message "Please, press enter to activate this console" It blocks, If I press enter it does nothing. I am using a wireless keyboard but I am pretty sure it works because it was working with the Raspbian. I am attaching the log. I tested with two raspberries pi and two sdcards. If you have a clue in what it is going on I would really appreciate your help. Thanks :)

Sorry if I offended you =/

It was easier, I couldn't copy and paste.

blub • 5 months ago

hi,

i have as 2nd networkdevice the wifi rtl8188cu. I dont find a driver to install. Could u please tell me how i get this working.

thank

Jim • 6 months ago

Hello,

Is SSH enable at the first boot with OpenWRT?

I can only try with SSH conection...

DEVESH PARMAR • 7 months ago

i followed all the steps of flashing but since i dont have monitor therefore to get the console of Open WRT i used ssh connection using putty but it require login and password so for login i use root but i have no idea about what would be the password.

Thanks

Leigh de Paor > DEVESH PARMAR • 4 months ago

<http://wiki.openwrt.org/doc/ho...>

Leigh de Paor > DEVESH PARMAR • 4 months ago

<http://wiki.openwrt.org/doc/ho...>

alex • 8 months ago

Do you mind sharing the config file that you used for compiling the modified image ? I did try to compile from attitude_adjustment branch but somehow it did not issue DHCP to get IP address. I do not have monitor connected so i have no idea what's going on.

imad • 9 months ago

you didn't need 2 interfaces ?

raspi has just a one

Ben Miller > imad • 9 months ago

There are two interfaces. The "INTELLINET Hi-Speed USB 2.0" listed in the Components section is a second USB interface that is added to the Pi during the Assemble the Raspberry Pi section.