

# Networking Hardware

Information and guides related to home networking and computer hardware, including Routers, PCs, devices, and appliances.

- Router Firmware for SOHO Equipment
  - Fresh Tomato
  - DD-WRT
  - OpenWRT
- Open Source Router Software
  - OPNsense

# Router Firmware for SOHO Equipment

Router custom firmware information for common models of Small Office/Home Office router equipment, such as Netgear, Asus, and Linksys routers.

# Fresh Tomato



# ..FRESH TOMATO..

**FreshTomato** is a firmware project based on Linux, targeting home and SOHO routers. FreshTomato is distributed on the [GPL license](#).

FreshTomato supports Broadcom based systems.

“ I currently run Fresh Tomato firmware on several Netgear Nighthawks. The R7000 and R8000 are my current preferred routers for Fresh Tomato firmware.

It is far superior in both security and features than the original Netgear firmware that came with these routers. Unlike Netgear, updates for the router firmware to address security vulnerabilities or correct bugs are available on a regular basis. Netgear would usually take well over a year to address security issues, if at all.

FreshTomato (beta)

Version 2020.3 on Asus RT-N66U

N66U

About

Reboot...

Shutdown...

Logout

Status

Overview

Device List

Web Usage

Logs

Bandwidth

IP Traffic

Tools

Basic

Advanced

Port Forwarding

Access Restriction

DoS

Bandwidth Limiter

Captive Portal

Web Server

USB and NAS

VPN Tunneling

Administration

System

Ethernet Ports State

WWAN Modem Status

WAN

LAN

Wireless (2.4 GHz / eth1)

Wireless (5 GHz / eth2)

Wireless (2.4 GHz / wlan1)

System

Name

Model

Bootloader (CFE)

Chipset

CPU Frequency

Flash Size

Time

Uptime

CPU Load (1 / 5 / 15 mins)

Total / Free Memory

Total / Free NVRAM

N66U

Asus RT-N66U

1.0.1.9

Broadcom BCM5300 chip rev 1 pkg 0

600MHz

32MB

Mon, 20 Apr 2020 18:07:54 +0200

0 days, 00:04:31

1.23 / 0.71 / 0.29

249.39 MB / 221.96 MB (89.00%)

64.00 KB / 24.04 KB (37.55%)

Ethernet Ports State

LAN0

LAN1

LAN2

LAN3

LAN4

Unplugged

100M Full

Unplugged

Unplugged

Unplugged

WWAN Modem Status

Modem type

Current Mode

RSSI

RSRP

RSRQ

SINR

Location

hilink

LTE

-71 dBm

-103 dBm

-9 dBm

-1 dB

MCC: 2  
MNC: 06  
LAC: 0x0 (0)  
Cell ID: 0x20 (211)  
PCI: 0x155 (341)

WAN

MAC Address

Connection Type

IP Address

Subnet Mask

Gateway

DNS

MTU

Status

Connection Uptime

Remaining Lease Time

50:46:...

4G/LTE

192.168.8.100

255.255.255.0

192.168.8.1

192.168.8.153

1500

Connected

0 days, 00:02:51

0 days, 23:57:09

Renew

Release

LAN

Router MAC Address

Router IP Addresses

DHCP

50:46:...

br0 (LAN) - 192.168.1.1/24  
br1 (LAN1) - 192.168.2.1/24  
br2 (LAN2) - 192.168.3.1/24

br0 (LAN) - 192.168.1.2 - 192.168.1.51  
br1 (LAN1) - 192.168.2.2 - 192.168.2.51  
br2 (LAN2) - 192.168.3.2 - 192.168.3.51

Wireless (2.4 GHz / eth1)

MAC Address

Wireless Mode

Wireless Network Mode

Interface Status

Radio

SSID

Broadcast

Security

Channel

Channel Width

Interference Level

Rate

50:46:...

Access Point

Auto

Up (LAN)

Enabled

pedro-test2

Enabled

WPA2 Personal (PSK) + AES

6 - 2.437 GHz

40 MHz

Acceptable

54 Mbps

Enable

Disable

Wireless (5 GHz / eth2)

MAC Address

Wireless Mode

Wireless Network Mode

Interface Status

Radio

SSID

Broadcast

Security

Channel

Channel Width

Interference Level

Rate

50:46:...

Access Point

Auto

Up (LAN)

Enabled

pedro-test5-2

Enabled

WPA2 Personal (PSK) + AES

104 - 5.520 GHz

40 MHz

Acceptable

450 Mbps

Enable

Disable

Wireless (2.4 GHz / wlan1)

MAC Address

Wireless Mode

Interface Status

SSID

Broadcast

Security

52:46:...

Access Point

Up (LAN1)

pedro-guest

Enabled

WPA2 Personal (PSK) + AES

3 seconds

Stop

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## Installing on a R8000 Router

Since I use Netgear Nighthawk R8000 routers in my environment, I thought I would outline the process I use to flash fresh Tomato firmware to them. Fresh Tomato supports other broadcom based routers as well. If you have another make and model of router, you can check if yours is supported by going [here](#).

Be sure to read the installation information for your model of router. This installation guide is simply the way I install the firmware on my R8000 routers. I do not imply any guarantee this will work for yours. You are responsible for taking the risk.

“ I will get the instructions in here as soon as time permits. A bit busy with life at the moment.

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## Fixing a 'Bricked' R8000 Router

Recently, I decided I wanted a router as a "shelf spare" in the event one of my production routers failed. Since I have previously flashed many R8000s for myself without issue, I proceeded to purchase a used R8000 from eBay. This particular router, however, 'bricked' on me when I attempted to flash Tomato firmware to it.

“Bricking” essentially means a device has turned into a brick. It may be an electronic device worth hundreds of dollars, but it’s now as useful as a brick (or perhaps a paperweight). A bricked device won’t power on and function normally. A bricked device cannot be fixed through normal means.

Anyway, I thought I would detail the steps and requirements I used to 'unbrick' my router and get it working with Tomato firmware.

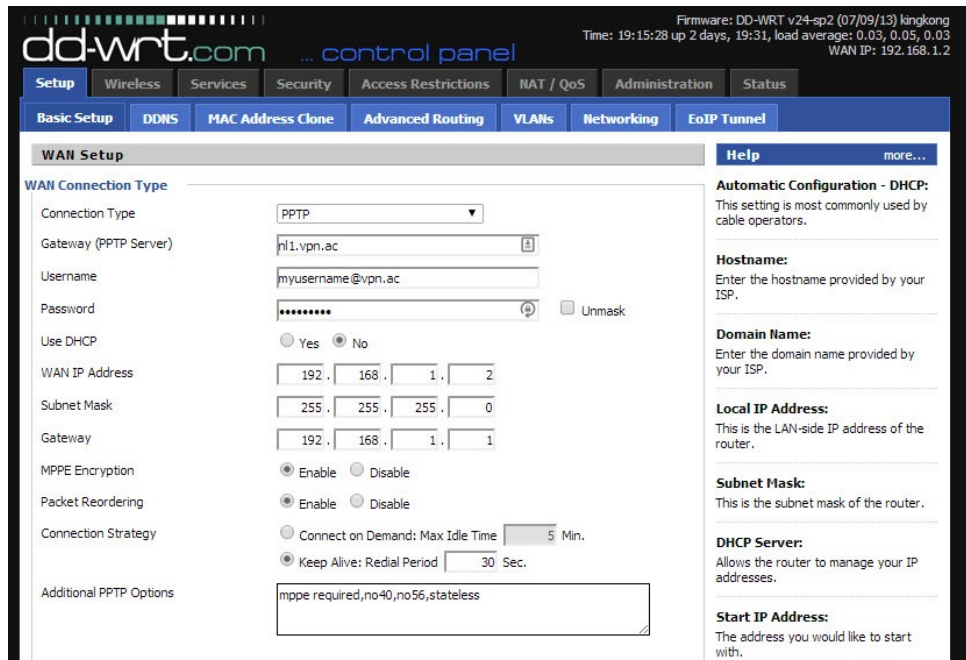
“ I will get the instructions in here as soon as time permits. A bit busy with life at the moment.



# DD-WRT



**DD-WRT** is a Linux based alternative OpenSource firmware suitable for a great variety of WLAN routers and embedded systems. The main emphasis lies on providing the easiest possible handling while at the same time supporting a great number of functionalities within the framework of the respective hardware platform used.



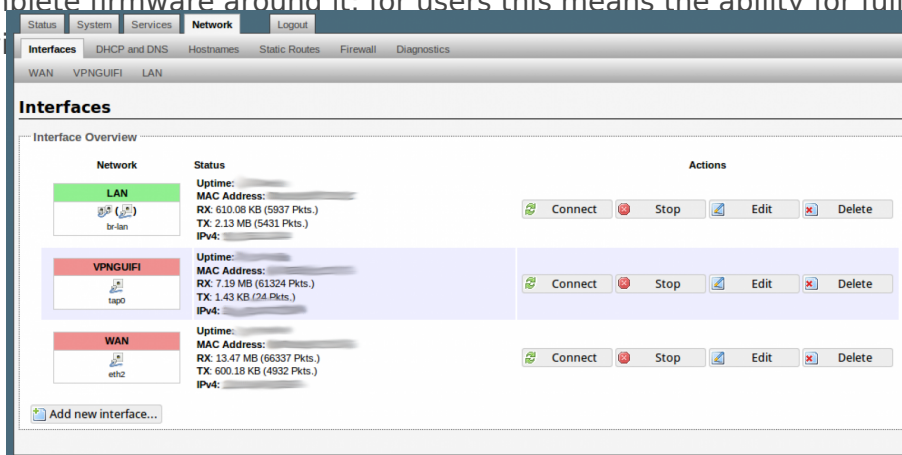
The screenshot displays the DD-WRT control panel interface. At the top, the status bar shows the firmware version (DD-WRT v24-sp2), date (07/09/13), and location (kingkong). Below this, a navigation menu includes tabs for Setup, Wireless, Services, Security, Access Restrictions, NAT / QoS, Administration, and Status. The 'Setup' tab is active, and the 'WAN Setup' sub-tab is selected. The main configuration area is titled 'WAN Connection Type' and features a dropdown menu set to 'PPTP'. Below this, fields for Gateway (PPTP Server), Username, Password, and Unmask are visible. The 'Use DHCP' section has radio buttons for 'Yes' and 'No', with 'No' selected. The 'WAN IP Address' section includes input fields for IP, Subnet Mask, and Gateway. The 'MPPE Encryption' and 'Packet Reordering' sections have radio buttons for 'Enable' and 'Disable', with 'Enable' selected. The 'Connection Strategy' section has radio buttons for 'Connect on Demand: Max Idle Time' and 'Keep Alive: Redial Period', with 'Keep Alive: Redial Period' selected. The 'Additional PPTP Options' section contains a text area with the value 'mppe required,no40,no56,stateless'. On the right side, a 'Help' section provides information about Automatic Configuration - DHCP, Hostname, Domain Name, Local IP Address, Subnet Mask, DHCP Server, and Start IP Address.

DD-WRT Control Panel

# OpenWrt



The **OpenWrt** Project is a Linux operating system targeting embedded devices. Instead of trying to create a single, static firmware, OpenWrt provides a fully writable filesystem with package management. This frees you from the application selection and configuration provided by the vendor and allows you to customize the device through the use of packages to suit any application. For developers, OpenWrt is the framework to build an application without having to build a complete firmware around it; for users this means the ability for full customization, to use the device



LuCi Interface for OpenWrt



# Open Source Router Software

Software for building your own router/firewall/IDS/IPS appliance.

# OPNsense



<https://opnsense.org/>

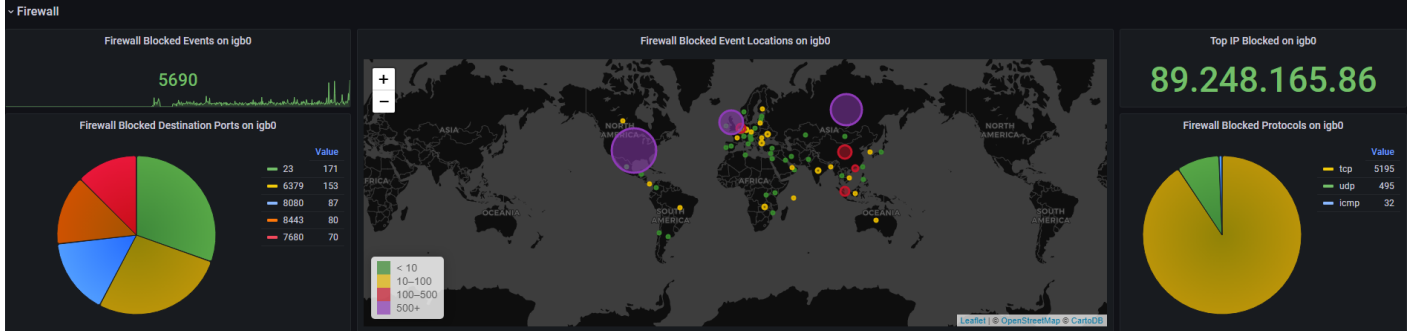
**OPNsense** is an open source, FreeBSD-based firewall and routing software.

Installed on appropriate hardware, it replaces SOHO routers with a much more robust, effective and powerful appliance to protect your home network. Using built-in and available add-ons, you can build a feature set as simple or complex as you require. Integrations such as intrusion detection/prevention, DHCP and DNS services, VPN services, Firewall with aliasing just to name a few, come standard with OPNsense. Add-ons, both free and subscription-based are available. Using the add-ons, referred to as plug-ins in OPNsense, you can setup proxys, reverse-proxys, web caching, and much more.

As an example, I have my OPNsense appliance setup with extra security measures using Crowdsec, Maltrail, Country Blocking and Zen Armor (Formerly Suricata). I also have a Wireguard VPN setup to permit secure access to my internal devices and servers should I need to access them remotely. I utilize OPNsense's built-in Unbound DNS application to manage and secure my domain name services.

Frankly, I had been using consumer routers (NetGear, ASUS, etc) with custom firmware (DD-WRT, Fresh Tomato, etc) for years. They just couldn't keep up with the demands placed on them and they had very little in the way of firewall and no intrusion detection/prevention ability. Using OPNsense, I have essentially future-proofed my home network from most bad actors and have noticed a SIGNIFICANT improvement in throughput as well. You are really only limited by the hardware you choose to run it, which, even on low end hardware, is substantially more powerful than any high-end consumer (SOHO) router.

While OPNsense's default Lobby dashboard is pretty good, I'd recommend using a combination dashboard that utilizes InfluxDB, Grafana and Telegraph or Ansible. A really good example of this is Brendan Smith's implementation shown in the pic below and instructions for this dashboard can be found on his website ["How to Configure an OPNsense Dashboard"](#)



**Gateway RTT - All**

100 ms  
10 ms  
1 ms

16:00 20:00 00:00 04:00 08:00 12:00

min max avg current  
8.40 ms 34.1 ms 11.3 ms 34.1 ms

WAN\_DHCP



**Gateway Loss - All**

100%  
75%  
50%  
25%  
0%

16:00 20:00 00:00 04:00 08:00 12:00

max avg current  
0% 0% 0%

WAN\_DHCP

Gateway Summary - All			
Gateway Description 	Monitor IP 	Gateway IP 	Status 
Interface WAN_DHCP Gateway	0.0.0.0	0.0.0.0	online

The screenshot displays the Mikrotik WinBox interface for the WAN configuration of a MikroTik 7902 router. The top section shows the 'Interface Summary' for the 'igb0' interface, which is a WAN interface with an IPv4 address of 0.0.0.0 and a physical address of aa:aa:aa:aa:aa:aa. The status is 'UP'.

Below the summary, there are four traffic statistics charts for the 'igb0' interface:

- WAN Traffic - igb0 (Bits/sec):** A line graph showing traffic over time. The legend indicates 'Bits Recv' (green) and 'Bits Sent' (yellow). The current values are 223.44 Mb/s for reception and 24.24 Mb/s for transmission.
- igb0 - Bits Recv:** A line graph showing reception traffic. The current value is 5.51 Mb/s.
- igb0 - Bytes Recv - This Month:** A line graph showing reception traffic for the current month. The current value is 53.15 GiB.
- igb0 - Bits Sent:** A line graph showing transmission traffic. The current value is 28.68 Mb/s.
- igb0 - Bytes Sent - This Month:** A line graph showing transmission traffic for the current month. The current value is 1.83 GiB.
- WAN Throughput - igb0:** A line graph showing throughput over time. The legend indicates 'Packets Recv' (green) and 'Packets Sent' (yellow). The current values are 1.287 K for reception and 2.239 K for transmission.

The screenshot displays the Mikrotik WinBox interface for the 'igb1\_vlan5' interface. The top section shows the 'Interface Summary' with the following details:

- Interface: igb1\_vlan5
- Friendly Name: Home
- IPv4 Address: 172.16.5.1
- Physical Address: aa:aa:aa:aa:aa:aa
- Status: UP

Below the summary, four graphs are visible:

- LAN Traffic - igb1\_vlan5 (Bits/sec)**: A line graph showing traffic over time.
- LAN Traffic - igb1\_vlan5 - Bits Recv**: A line graph showing received bits per second, with a current value of **28.85 Mb/s**.
- LAN Traffic - igb1\_vlan5 - Bits Sent**: A line graph showing sent bits per second, with a current value of **30.04 Mb/s**.
- LAN Throughput - igb1\_vlan5**: A line graph showing throughput over time, with a current value of **1019.51 MiB**.

> LAN Interface - igb1\_vlan8 (5 panels)

