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.

Router Firmware for SOHO Equipment

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.

System

Name	N66U
Model	Asus RT-N66U
Bootloader (CFE)	1.0.1.9
Chipset	Broadcom BCM5300 chip rev 1 pkg 0
CPU Frequency	600MHz
Flash Size	32MB
Time	Mon, 20 Apr 2020 18:07:54 +0200
Uptime	0 days, 00:04:31
CPU Load (1 / 5 / 15 mins)	1.23 / 0.71 / 0.29
Total / Free Memory	249.39 MB / 221.96 MB (89.00%)
Total / Free NVRAM	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	hilink
Current Mode	LTE
RSSI	-71 dBm
RSRP	-103 dBm
RSRQ	-9 dBm
SINR	-1 dB
Location	MCC: 2 MNC: 06 LAC: 0x0 (0) Cell ID: 0x20. (21) PCI: 0x155 (341)

WAN

MAC Address	50:46:
Connection Type	4G/LTE
IP Address	192.168.8.100
Subnet Mask	255.255.255.0
Gateway	192.168.8.1
DNS	192.168.8.1:53
MTU	1500
Status	Connected
Connection Uptime	0 days, 00:02:51
Remaining Lease Time	0 days, 23:57:09

Renew Release

LAN

Router MAC Address	50:46:
Router IP Addresses	**br0** (LAN) - 192.168.1.1/24 **br1** (LAN1) - 192.168.2.1/24 **br2** (LAN2) - 192.168.3.1/24
DHCP	**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	50:46:
Wireless Mode	Access Point
Wireless Network Mode	Auto
Interface Status	Up (LAN)
Radio	Enabled
SSID	pedro-test2
Broadcast	Enabled
Security	WPA2 Personal (PSK) + AES
Channel	6 - 2.437 GHz
Channel Width	40 MHz
Interference Level	Acceptable
Rate	54 Mbps

Enable Disable

Wireless (5 GHz / eth2)

MAC Address	50:46:
Wireless Mode	Access Point
Wireless Network Mode	Auto
Interface Status	Up (LAN)
Radio	Enabled
SSID	pedro-test5-2
Broadcast	Enabled
Security	WPA2 Personal (PSK) + AES
Channel	104 - 5.520 GHz
Channel Width	40 MHz
Interference Level	Acceptable
Rate	450 Mbps

Enable Disable

Wireless (2.4 GHz / wl0.1)

MAC Address	52:46:
Wireless Mode	Access Point
Interface Status	Up (LAN1)
SSID	pedro-guest
Broadcast	Enabled
Security	WPA2 Personal (PSK) + AES

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.

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.

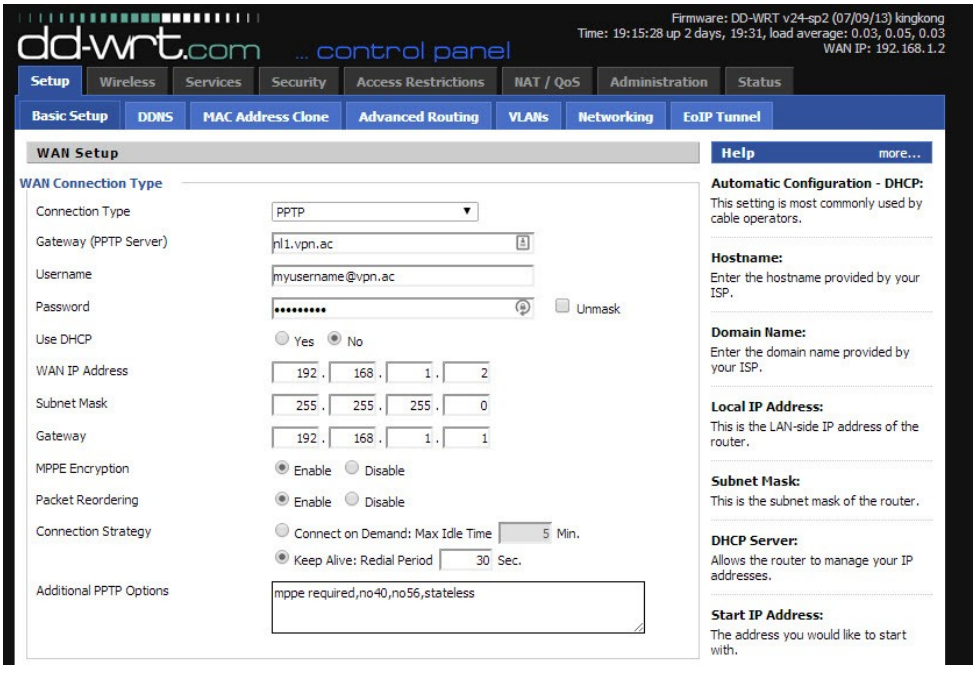
Anyway, I thought I would detail the steps and requirements I used to 'unbrick' my router and get it working with Tomato firmware.

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

Router Firmware for SOHO Equipment

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.

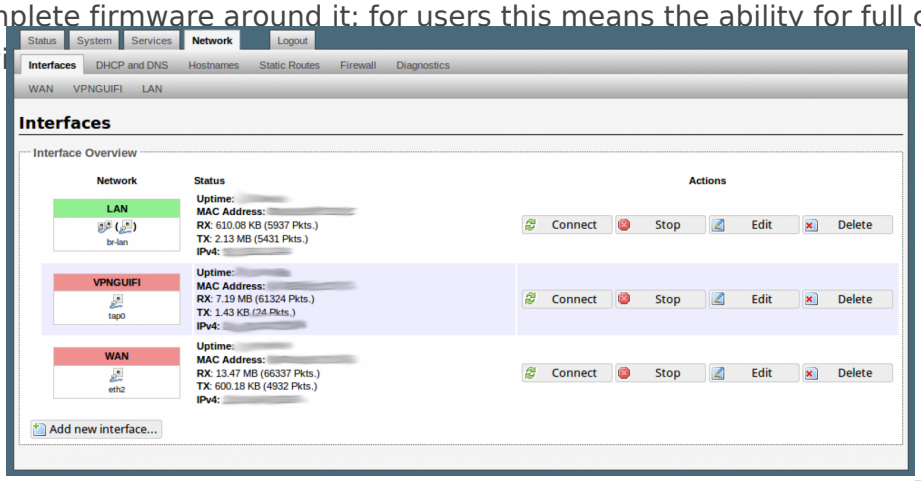


DD-WRT Control Panel

Router Firmware for SOHO Equipment

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 devi



LuCi Interface for OpenWrt

Open Source Router Software

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

Open Source Router Software

OPNsense

https://opnsense.org/

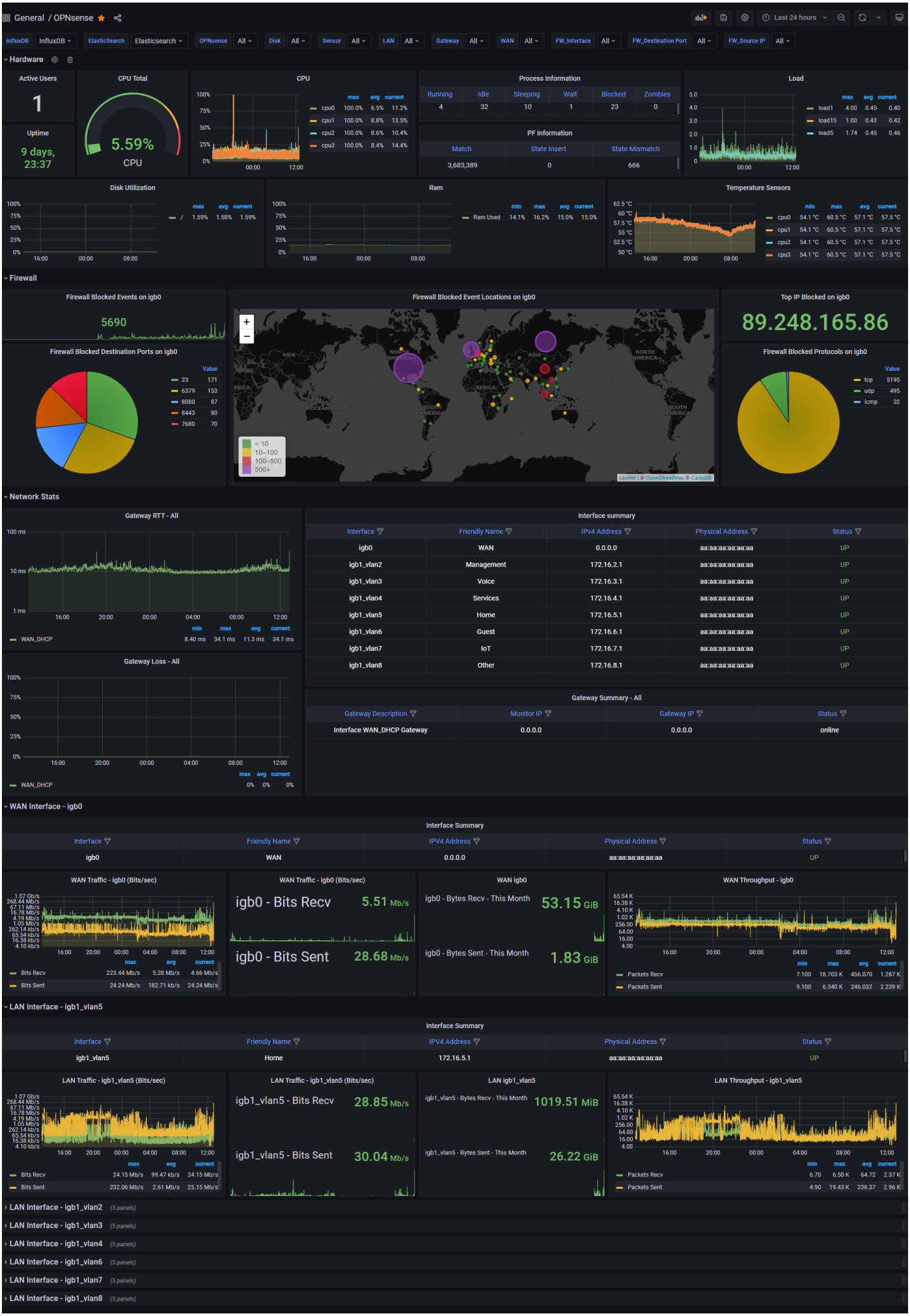
OPNsense is an open source, FreeBSD-based firewall and routing software.

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 instrusion 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 InfuixDB, Grafana and Telegraph or Ansible. A really good example of this is Brendan Smith's implementation shown in the pic below and instructiions for this dashboard can be found on his website "How to Configure an OPNsense Dashboard"


General / OPNsense
Last 24 hours
InfluxDB
InfluxDB
ElasticSearch
Elasticsearch
OPNsense
All
Disk
All
Sensor
All
LAN
All
Gateway
All
WAN
All
FW_Interface
All
FW_Destination Port
All
FW_Source IP
All
Hardware
Active Users
1
Uptime
9 days, 23:37
CPU Total
5.59%
CPU
CPU
max avg current
cpu0 100.0% 6.5% 11.2%
cpu1 100.0% 8.8% 13.5%
cpu2 100.0% 8.6% 10.4%
cpu3 100.0% 8.4% 14.4%
Process Information
Running Idle Sleeping Wait Blocked Zombies
4 32 10 1 23 0
PF Information
Match State Insert State Mismatch
3,683,389 0 666
Load
max avg current
load1 4.00 0.45 0.40
load15 1.00 0.43 0.42
load5 1.74 0.45 0.46
Disk Utilization
max avg current
/ 1.59% 1.58% 1.59%
Ram
min max avg current
Ram Used 14.1% 16.2% 15.0% 15.0%
Temperature Sensors
min max avg current
cpu0 54.1 °C 60.5 °C 57.1 °C 57.5 °C
cpu1 54.1 °C 60.5 °C 57.1 °C 57.5 °C
cpu2 54.1 °C 60.5 °C 57.1 °C 57.5 °C
cpu3 54.1 °C 60.5 °C 57.1 °C 57.5 °C
Firewall
Firewall Blocked Events on igb0
5690
Firewall Blocked Destination Ports on igb0
Value
23 171
6379 153
8080 87
8443 80
7680 70
Firewall Blocked Event Locations on igb0
< 10
10–100
100–500
500+
Leaflet | © OpenStreetMap © CartoDB
Top IP Blocked on igb0
89.248.165.86
Firewall Blocked Protocols on igb0
Value
tcp 5195
udp 495
icmp 32
Network Stats
Gateway RTT - All
min max avg current
WAN_DHCP 8.40 ms 34.1 ms 11.3 ms 34.1 ms
Gateway Loss - All
max avg current
WAN_DHCP 0% 0% 0%
Interface summary
Interface Friendly Name IPv4 Address Physical Address Status
igb0 WAN 0.0.0.0 aa:aa:aa:aa:aa:aa UP
igb1_vlan2 Management 172.16.2.1 aa:aa:aa:aa:aa:aa UP
igb1_vlan3 Voice 172.16.3.1 aa:aa:aa:aa:aa:aa UP
igb1_vlan4 Services 172.16.4.1 aa:aa:aa:aa:aa:aa UP
igb1_vlan5 Home 172.16.5.1 aa:aa:aa:aa:aa:aa UP
igb1_vlan6 Guest 172.16.6.1 aa:aa:aa:aa:aa:aa UP
igb1_vlan7 IoT 172.16.7.1 aa:aa:aa:aa:aa:aa UP
igb1_vlan8 Other 172.16.8.1 aa:aa:aa:aa:aa:aa UP
Gateway Summary - All
Gateway Description Monitor IP Gateway IP Status
Interface WAN_DHCP Gateway 0.0.0.0 0.0.0.0 online
WAN Interface - igb0
Interface Summary
Interface Friendly Name IPV4 Address Physical Address Status
igb0 WAN 0.0.0.0 aa:aa:aa:aa:aa:aa UP
WAN Traffic - igb0 (Bits/sec)
max avg current
Bits Recv 223.44 Mb/s 5.28 Mb/s 4.66 Mb/s
Bits Sent 24.24 Mb/s 182.71 kb/s 24.24 Mb/s
WAN Traffic - igb0 (Bits/sec)
igb0 - Bits Recv 5.51 Mb/s
igb0 - Bits Sent 28.68 Mb/s
WAN igb0
igb0 - Bytes Recv - This Month 53.15 GiB
igb0 - Bytes Sent - This Month 1.83 GiB
WAN Throughput - igb0
min max avg current
Packets Recv 7.100 18.703 K 456.070 1.287 K
Packets Sent 9.100 6.340 K 246.032 2.239 K
LAN Interface - igb1_vlan5
Interface Summary
Interface Friendly Name IPV4 Address Physical Address Status
igb1_vlan5 Home 172.16.5.1 aa:aa:aa:aa:aa:aa UP
LAN Traffic - igb1_vlan5 (Bits/sec)
max avg current
Bits Recv 24.15 Mb/s 99.47 kb/s 24.15 Mb/s
Bits Sent 232.06 Mb/s 2.61 Mb/s 25.15 Mb/s
LAN Traffic - igb1_vlan5 (Bits/sec)
igb1_vlan5 - Bits Recv 28.85 Mb/s
igb1_vlan5 - Bits Sent 30.04 Mb/s
LAN igb1_vlan5
igb1_vlan5 - Bytes Recv - This Month 1019.51 MiB
igb1_vlan5 - Bytes Sent - This Month 26.22 GiB
LAN Throughput - igb1_vlan5
min max avg current
Packets Recv 6.70 6.50 K 64.72 2.37 K
Packets Sent 4.90 19.43 K 236.37 2.96 K
LAN Interface - igb1_vlan2 (5 panels)
LAN Interface - igb1_vlan3 (5 panels)
LAN Interface - igb1_vlan4 (5 panels)
LAN Interface - igb1_vlan6 (5 panels)
LAN Interface - igb1_vlan7 (5 panels)
LAN Interface - igb1_vlan8 (5 panels)