

Liberte seu roteador sem fio

- Wireless Router Hacks -



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Explanações... Ou sobre o que falaremos!

- introdução sobre os hardwares de roteadores wireless
- suas generalidades, particularidades e possibilidades
- sistema embarcado openWRT

Intro...

Origem: projeto de redes mesh da ASL.org

Interesse e necessidade de troca de firmware

Idéia politicamente "correta"

Nível de "hacking" médio

Alta melhoria na qualidade serviços do router

Inúmeros novos recursos, estatísticas e possibilidades

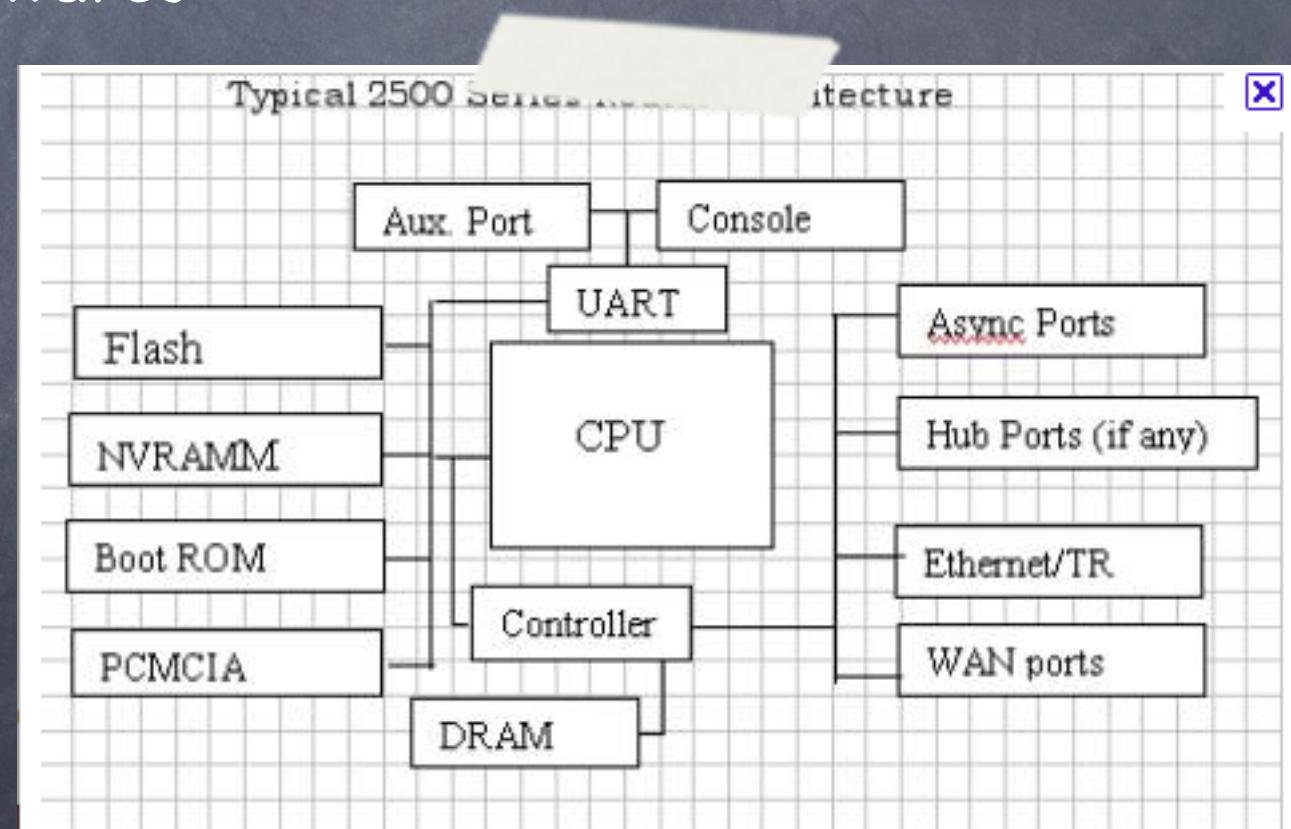
Hardwares

Paralelo aos computadores padrão x86

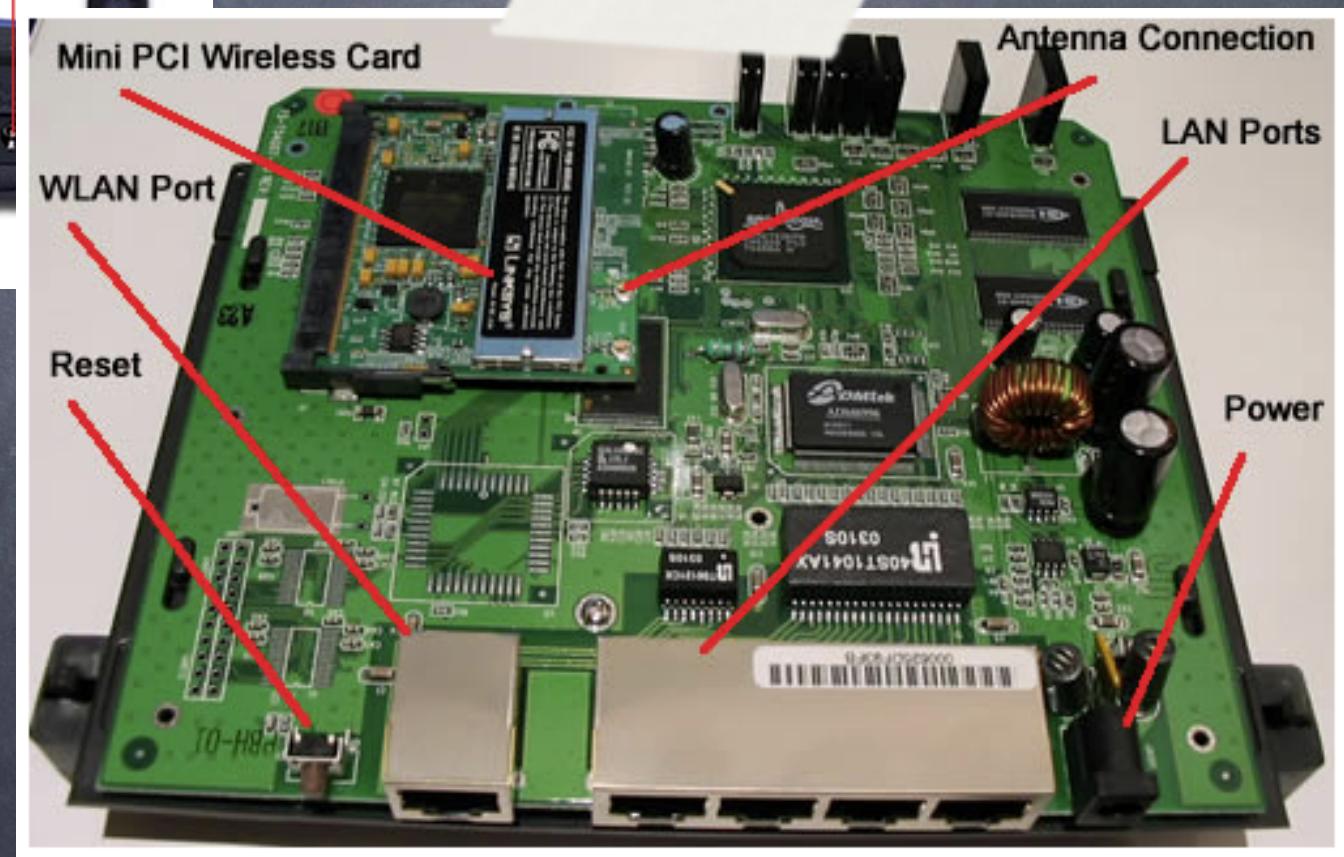
Análise de limitações de hardware e/por software

Outras opções de firmwares

Roteadores são
computadores!!!



Necropsia do Router



Hardware

Sistema - Chipset

- atheros
- broadcom
- ...



Processadores

- arm
- mips
- ...



Memórias

Bios - ROM

- funções básicas hardware

NVRAM

- boot loader



FLASH

- sistema operacional armazenado
- sistema de arquivos



RAM

- sistema em execução
- tabelas de roteamento



Antenas

- omnidirecionais (360°)

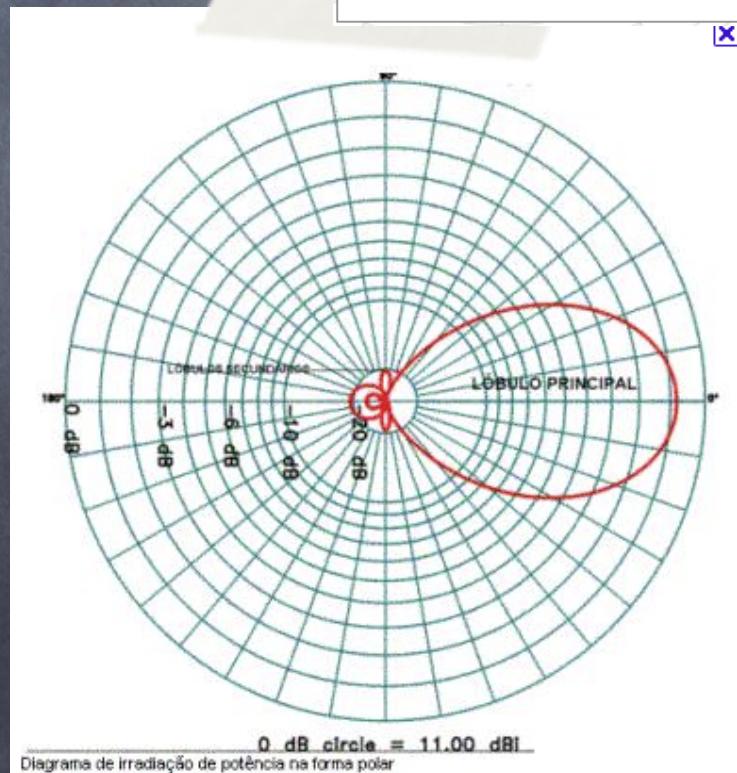
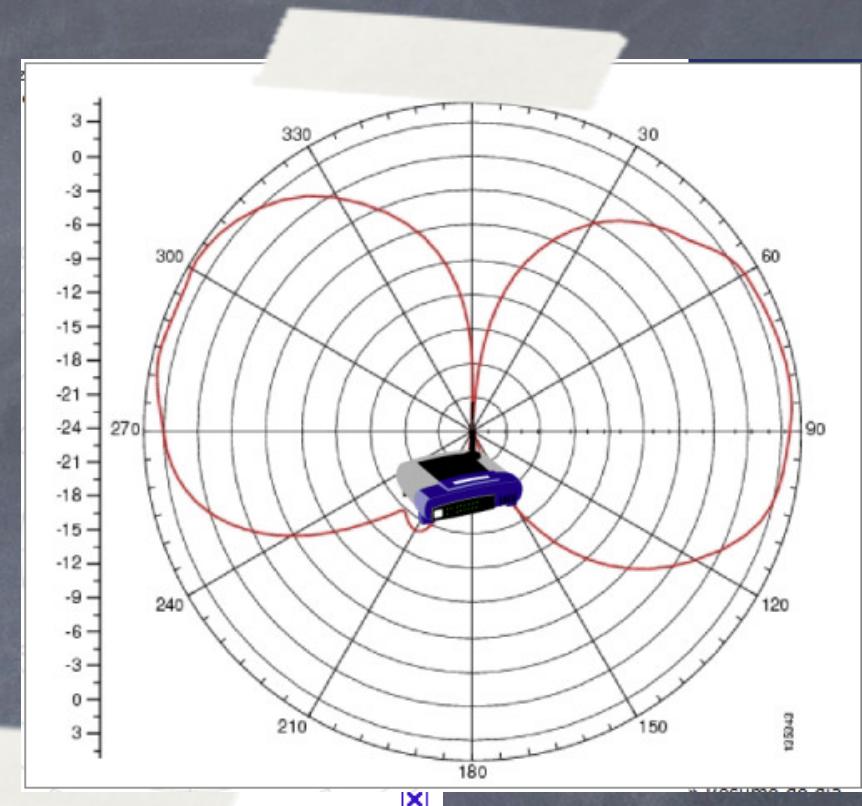
expande área

- direcionais (variável - 45°)

expande alcance

Alcance / potência

/ inclusive para clientes



2.4 GHz Spectrum

Channel Number	Channel in GHz
1	2.412
2	2.417
3	2.422
4	2.427
5	2.432
6	2.437
7	2.442
8	2.447
9	2.452
10	2.457
11	2.462

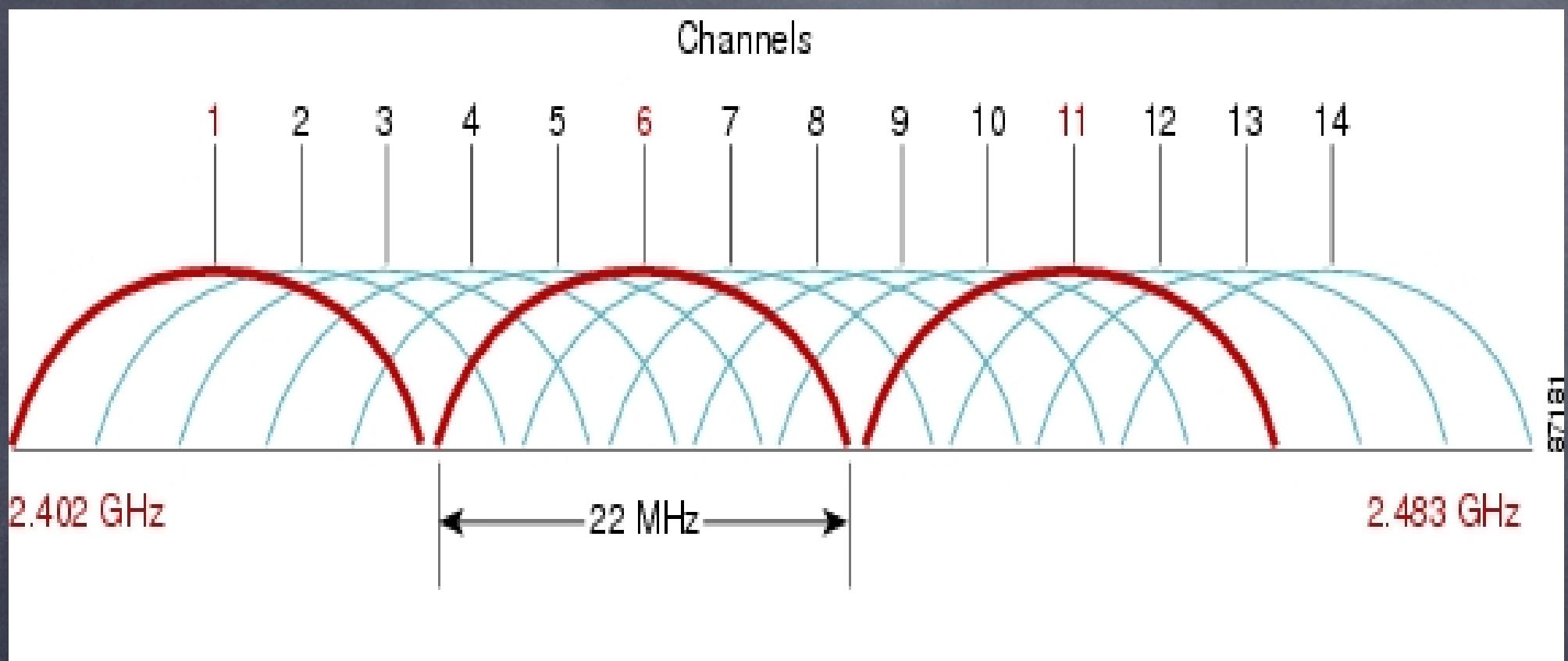
2.4GHz - has 3 non-overlapping channels separated by 20MHz (1, 6 and 11). Using 40MHz channel bonding would require using two of the three available channels.

5 GHz Spectrum

Channel Number	Channel in GHz
34	5.170
36	5.180
38	5.190
40	5.200
42	5.210
44	5.220
46	5.230
48	5.240
52	5.260
56	5.280
60	5.300
64	5.320
100	5.500
104	5.520
108	5.540
112	5.560
116	5.580
120	5.600
124	5.620
128	5.640
132	5.660
136	5.680
140	5.700
149	5.745
153	5.765
157	5.785
161	5.805
165	5.825

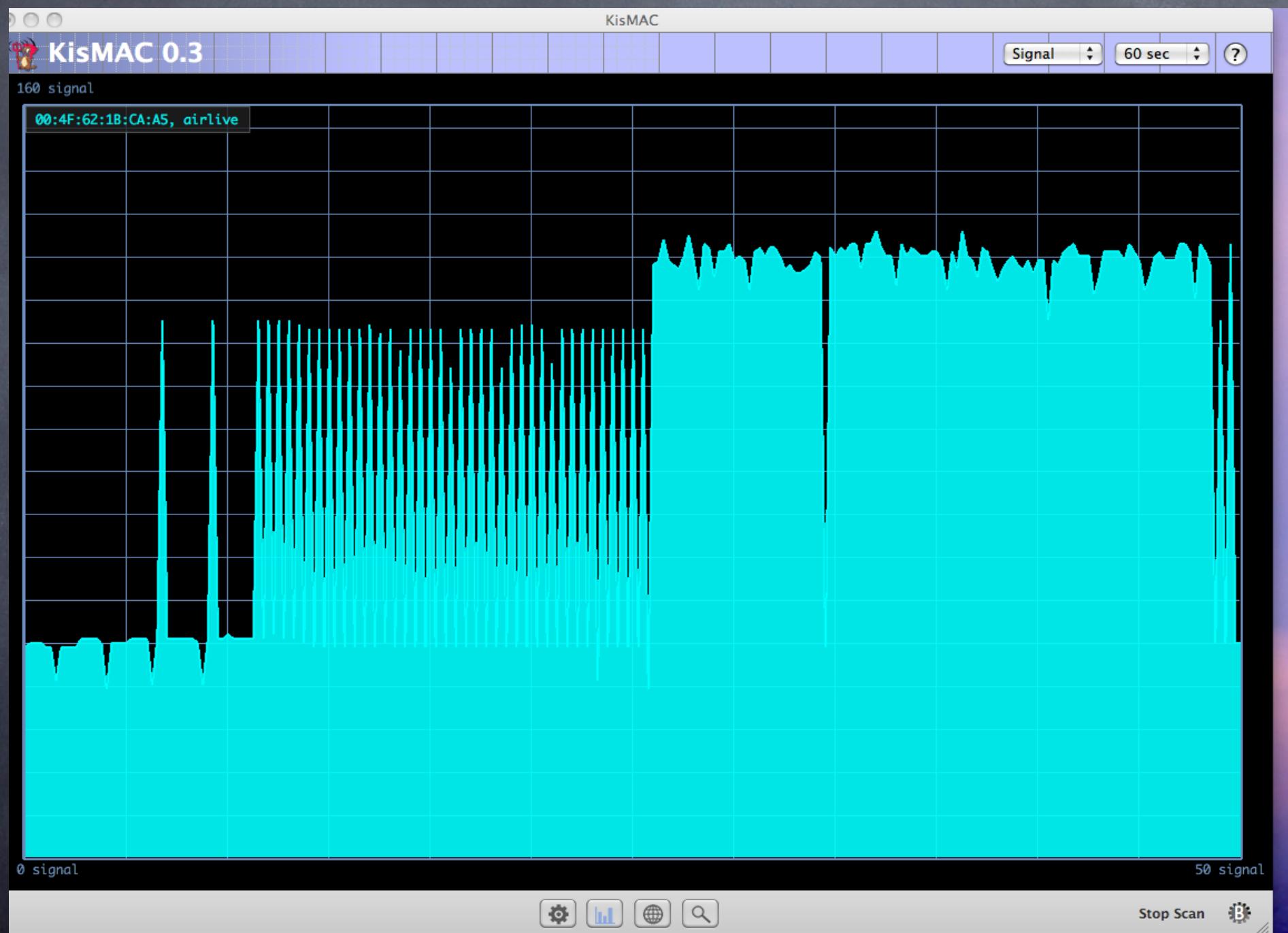
5GHz - has 24 non-overlapping channels separated by 20MHz. This allows up to 12 non-overlapping 40MHz channels.

Canais (sobreposição)



Interferência destrutiva / construtiva
Saturação

Aumento potência via software



Finalmente...

- Com o uso de software livre nos routers estes passam a ter recursos que os fabricantes “esquecem” de colocar em suas firmwares :(
- Acesso remoto via ssh
- Múltiplas redes wifi, WDS, repeater, adhoc
- Gerenciamento switch (VLANS)
- Diferentes protocolos: como os para redes em malha - mesh (OLSR, B.A.T.M.A.N., etc.)
- Enfim, tudo o que o GNU/Linux pode fazer por você! (e seu hardware permitir claro!)

Sistemas Operacionais - Distros

Algumas distribuições e/ou forks:

Distros

DD-WRT

The screenshot shows the DD-WRT control panel interface. At the top, it displays the DD-WRT logo and the text "... control panel". On the right side, there are status messages: "Firmware: DD-WRT v24 RC-7 (02/11/08) mini", "Time: 05:48:50 up 9:08, load average: 0.30, 0.12, 0.03", and "WAN IP: 222.222.222.222". Below the header is a navigation menu with tabs: Setup, Wireless, Services, Security, Access Restrictions, NAT / QoS, Administration, and Status. The "Status" tab is currently selected, which is highlighted by a blue background. Under the "Status" tab, there are two main sections: "Router Information" and "CPU".

Router Information

System		
Router Name	Buffalo	
Router Model	Buffalo WHR-HP-G54	
Firmware Version	DD-WRT v24 RC-7 (02/11/08) mini - build 8995	
MAC Address	00:1D:73:REDACTED	
Host Name		
WAN Domain Name		
LAN Domain Name		
Current Time	Tue, 12 Feb 2008 05:48:50	
Uptime	9:08	

CPU

CPU Model	Broadcom BCM5352 chip rev 0	
CPU Clock	200 MHz	
Load Average	0.30, 0.12, 0.03	
		15%

Help more...

Router Name:
This is the specific name for the router, which you set on the [Setup tab](#).

MAC Address:
This is the router's MAC Address, as seen by your ISP.

Firmware Version:
This is the router's current firmware.

Current Time:
This is time received from the ntp server set on the [Administration / Management tab](#).

Uptime:
This is a measure of the time the router has been "up" and running.

Load Average:
This is given as three numbers that represent the system load during the last one, five, and fifteen minute periods.

Versão comercial e gratuita.

Distros

OpenWrt
interface
web Luci

The screenshot shows the OpenWrt web interface (Luci) for managing Dynamic DNS. The top navigation bar includes links for Overview, Status, System, Services, Network, and Administration (with Essentials). The Administration section is currently selected. The page title is "Dynamic DNS". A sub-header states: "Dynamic DNS allows that your router can be reached with a fixed hostname while having a dynamically changing IP-Address." Below this, there is a form with the following fields:

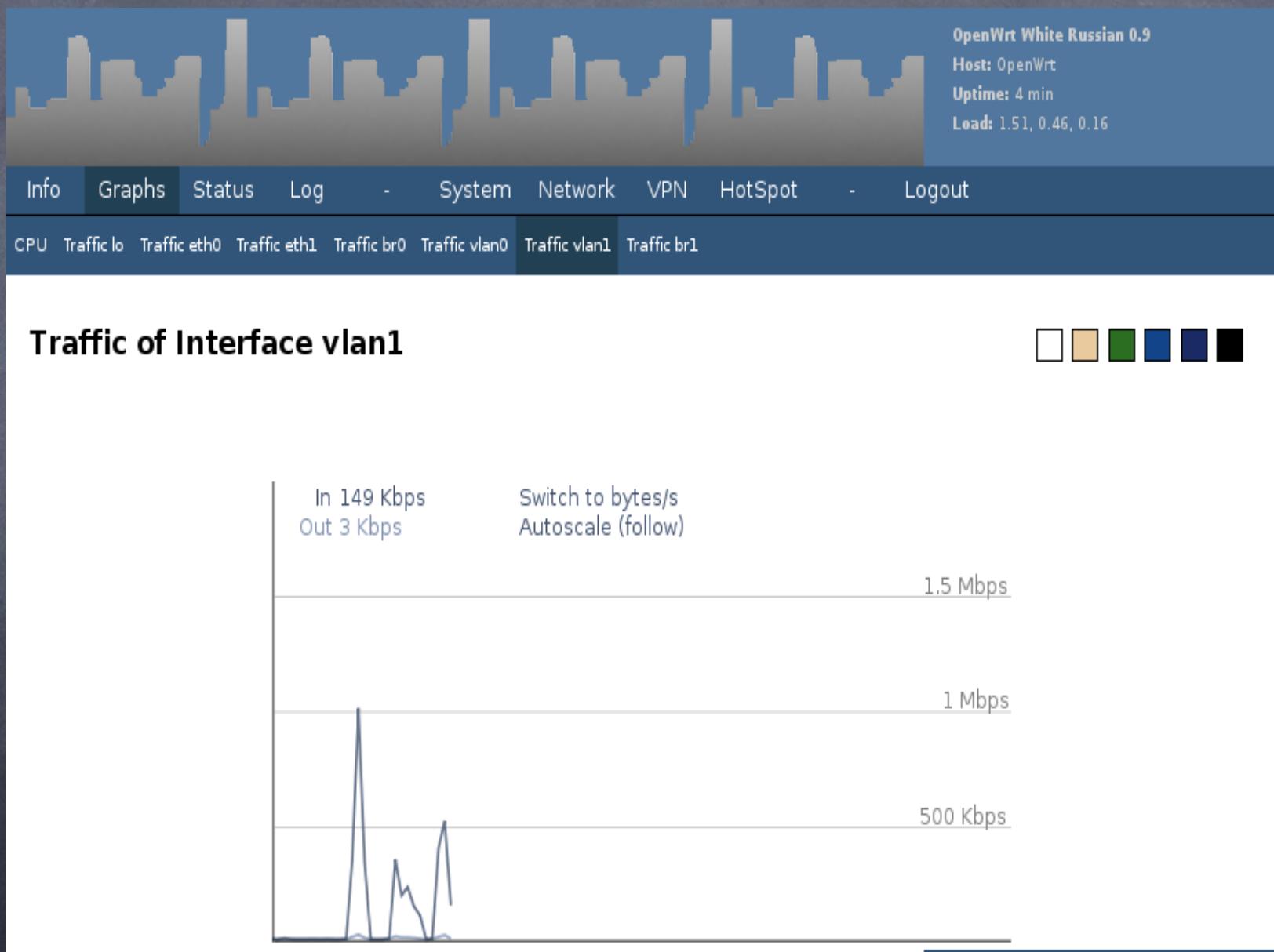
enable	<input checked="" type="checkbox"/>	<input type="checkbox"/> Remove entry
Service	dyndns.org	
Hostname	wikipedia.homesg.net	
Username	wikipedia	
Password	*****	
Source of IP-Address	Network	
Network	wan	
Check for changed IP every	10	
Check-Time unit	min	
Force update every	10	
Force-Time unit	5	
[- Additional field -]		Add
		Add entry

At the bottom right of the form are three buttons: Reset (red), Save (green), and Save & Apply (green).

At the very bottom of the page, it says "Powered by LuCI 0.9.7 Release (v0.9.7)".

Distros

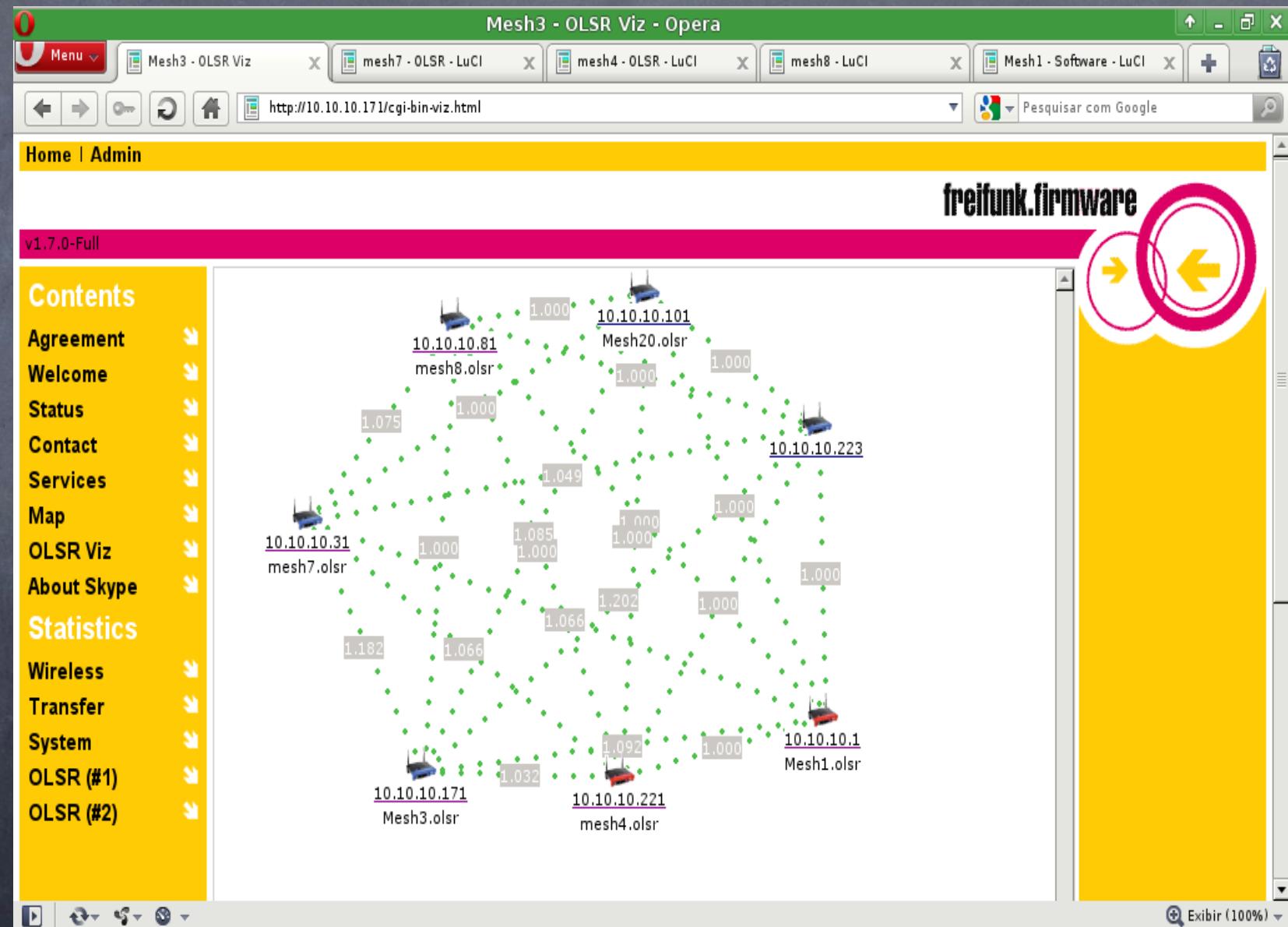
OpenWRT
interface
web xwrt



Distros

OpenWRT
rodando
Freifunk 1.7

Rede
Mesh
OLSR



Distros

Talisman

Firmware Version: Talisman/Basic 1.0.1

Setup Wireless Security Access Restrictions Applications & Gaming Administration Status

Management Log Diagnostics Factory Defaults Firmware Upgrade Backup

CONNECT Help...

Router Password

Local Router Password: Router Password:
Re-enter to confirm:

Remote Router Access

Remote Management Management Port: Use https:

AP Watchdog AP Watchdog: Interval:

Tomato Version 1.19

BUFFALO WHR-HP-054

Status Overview Device List Logs Bandwidth Real-Time Last 24 Hours Daily Weekly Monthly Tools Ping Trace Wireless Survey WOL Basic Advanced Port Forwarding QoS Access Restriction Administration About Reboot... Shutdown... Logout

WAN (vlan1) VLL (eth1) br0 eth0 wlan0

Mon 21:16 / 592.45 kbit/s (74.06 kB/s)

952.15 kbit/s (119.02 kB/s)

634.77 kbit/s (79.35 kB/s)

317.38 kbit/s (39.27 kB/s)

(10 minute window, 2 second interval)

RX 2.46 кбайт (0.30 квн) Avg 215.93 кбайт (26.36 квн) Peak 941.44 кбайт (114.92 квн) Total 15.44 мв

TX 1.60 кбайт (0.20 квн) Avg 73.47 кбайт (9.97 квн) Peak 230.94 кбайт (28.19 квн) Total 5,381.13 мв

Avg: Off, 2x, 4x, 6x, 8x
Max: Uniform, Per IF
Display: Solid, Line
Color: Blue & Orange » [reverse]

» Configure

The image displays two distinct router management interfaces side-by-side. The left interface, 'Talisman', has a red header and a dark grey body. It features tabs for Setup, Wireless, Security, Access Restrictions, Applications & Gaming, Administration, and Status. Below these are links for Management, Log, Diagnostics, Factory Defaults, Firmware Upgrade, and Backup. A 'CONNECT' section contains fields for 'Router Password' and 'Re-enter to confirm'. The right interface, 'Tomato', has a red header and a white body. It displays the version 'Version 1.19' and the router model 'BUFFALO WHR-HP-054'. It includes a navigation menu on the left with links like Status, Overview, Device List, Logs, Bandwidth, Tools, and Administration. The main area features a 'Bandwidth' graph for 'WAN (vlan1)' showing data over a 10-minute window with 2-second intervals. Below the graph are detailed tables for RX and TX traffic, showing values in bytes and kilobytes per second. The Tomato interface also includes configuration options at the bottom.

Distros

RouterTech.Org - The independent technical support site for all things networking

Advanced

You can configure advanced features like RIP, Firewall, NAT, UPnP, IGMP, Bridge Filters, and LAN clients.

UPnP	Configure UPnP for different connections.
SNTP	Configure SNTP to configure time server on Internet.
DDNS	Configure DDNS.
IP Account	Configure IP Accounting.
IP QoS	Configure IP Quality of Service for different traffic types.
Port Forwarding	Configure Firewall and NAT pass-through for specific ports.
IP Filters	Configure Firewall to block your LAN PCs from accessing specific destinations.
LAN Clients	Configure LAN Clients.
LAN Isolation	Disable traffic between LANs.
Bridge Filters	Select to setup Bridge Filters.
Multicast	Configure Multicast pass-through for different protocols.
Static Routing	Configure Static routes.
Dynamic Routing	Configure RIP.
Access Control	Configure access control list.
Remote Web Access	Configure remote web access.

Log Out

Gargoyle
Router Management Utility
Device Name: OpenWrt

Status

Connection

- > Basic
- DHCP
- Dynamic DNS
- Routing

Firewall

System

Logout

Device Configuration

Configure Device As:

- Gateway (Default)
- Wireless Bridge/Repeater

Wireless Bridge/Repeater

Bridge IP:	192.168.1.5	(must be in AP subnet)	
Subnet Mask:	255.255.255.0	(same as AP mask)	
AP/Gateway IP:	192.168.1.1		
Wan Ethernet Port:	Disable		
Custom DNS:	<input type="checkbox"/>	<input type="text"/>	Add

Connect Via Client Bridge:

Repeater:	Repeater Disabled		
Transmit Power:	Max	31	(0 ~ 31dBm)
SSID to Join:	Gargoyle	<input type="button" value="Scan"/>	
Wireless Channel:	5		
Encryption:	WPA2 PSK		
Password:	*****		

Save Changes **Reset**

Gerador FreiFunk via WEB :D

OpenWrt Image builder

No preconfig ?

TARGET: ar71xx-10.03

PROFILE: DIR615C1

Webinterface: goss ?

Hostname: MeshX ?

Domain: Mesh ?

Latitude: 48.00000000 ?

Longitude: 10.00000000 ?

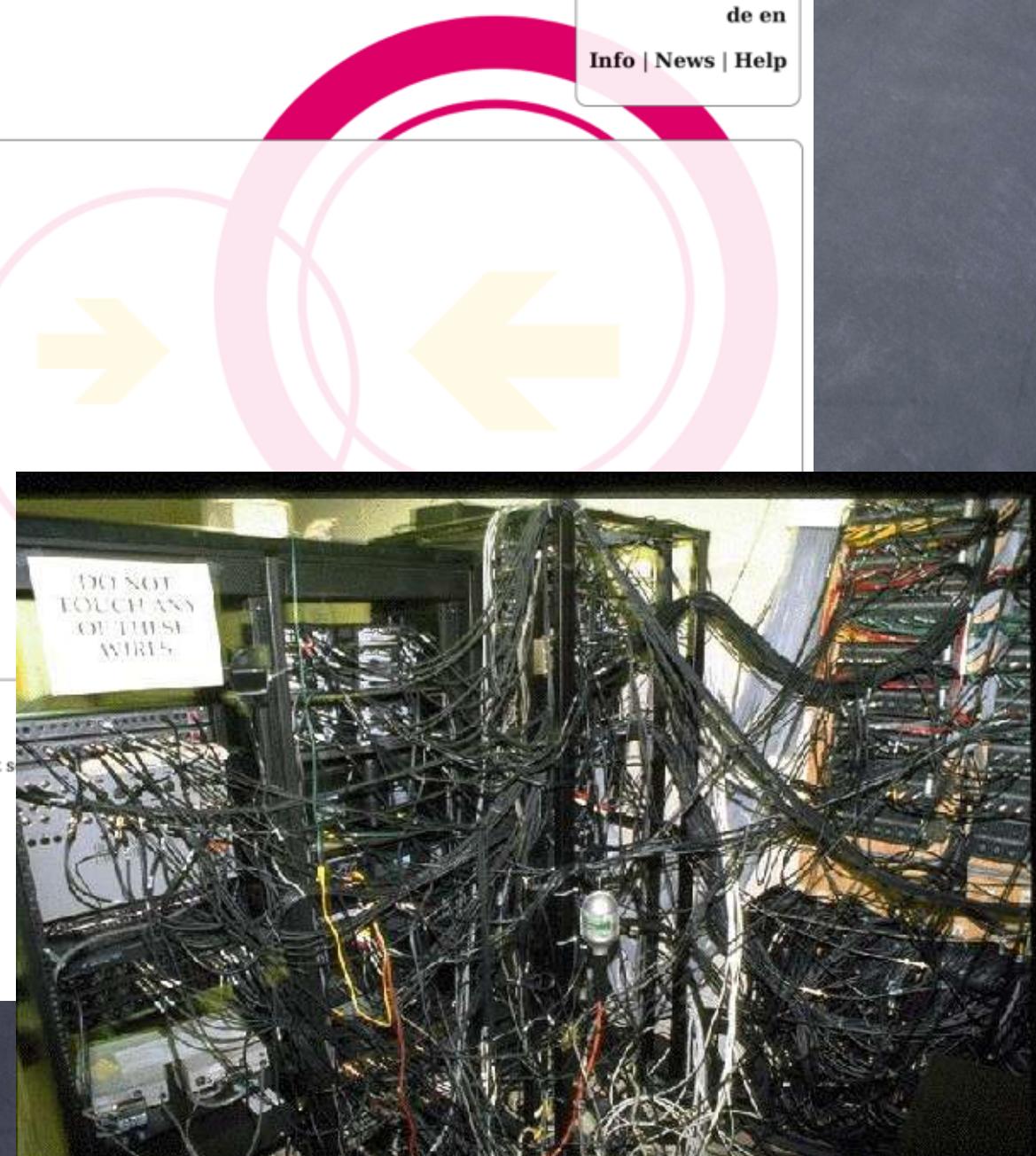
Version: 0.0.5

Images generated so far: 383

If you have any questions about or suggestions for this generator please write to freifunk at s

Customizável
on the fly!!!

de en
Info | News | Help



Generalidades

Acesso ao safemode: fórmula 20/20/20 (desligado, pressionando e aguardando) - vários routers aceitam

Alguns boot loaders precisam ser trocados

Upload via tftp

Mais modernos via web e até safemode web

OpenWRT

Definições de OpenWrt na web em inglês:

- OpenWrt is a Linux-based firmware program for embedded devices such as residential gateways. Support was originally limited to the Linksys WRT54G series, but has since been expanded to include other chipsets, manufacturers and device types, including Netgear, D-Link, Asus routers and many others ...
en.wikipedia.org/wiki/OpenWrt
- OpenWrt is a GNU/Linux distribution for WLAN devices made by Linksys, especially the WRT54G and the WRT54GS, though the distribution can be run on many devices from other firms. ...
www.networkdictionary.com/networking/o.php

OpenWRT

- White Russian
- Kamikaze
- BackFire (kernel 2.6)

```
BusyBox v1.11.2 (2009-09-06 01:25:20 UTC) built-in shell (ash)
Enter 'help' for a list of built-in commands.
```



```
KAMIKAZE (8.09.2-RC2, r17574) -----
```

```
* 10 oz Vodka      Shake well with ice and strain
* 10 oz Triple sec mixture i
* 10 oz lime juice Salute!
```

```
-----  
root@OpenWrt:~#  
root@OpenWrt:~# █
```



```
-----  
Backfire (10.03, $R) -----  
* 1/3 shot Kahlua   In a shot glass, layer Kahlua  
* 1/3 shot Bailey's on the bottom, then Bailey's,  
* 1/3 shot Vodka    then Vodka.  
-----
```

Para instalar o OpenWRT

Baixando a distro para seu equipamento

0. verificar a compatibilidade – site DD-WRT e do OpenWRT
1. identificar o processador e arquitetura – idem
2. identificando a versão do OpenWRT
3. fazer download dos arquivos corretos, verificar MD5SUMs'

Obs.: consulte wikis, fóruns e documentações de ambos projetos

Baixando OpenWRT

Index of /

[..](#)
[backfire/](#)
[backports/](#)
[docs/](#)
[kamikaze/](#)
[people/](#)
[reference/](#)
[snapshots/](#)
[sources/](#)
[utils/](#)
[whiterussian/](#)
[favicon.ico](#)

Index of /backfire/

..		
10.03/		21-Aug-2010 06:15
10.03-beta/		04-Mar-2010 01:39
10.03-rc1/		23-Mar-2010 23:14
10.03-rc2/		31-Mar-2010 17:36
10.03-rc3/		03-Apr-2010 00:31
10.03.1-rc1/		28-Aug-2010 19:52
10.03.1-rc2/		28-Aug-2010 19:52
10.03.1-rc3/		28-Aug-2010 19:50

Baixando OpenWRT

Index of /backfire/10.03.1-rc3/

.. /		
adm5120_router_be/	09-Aug-2010 08:24	-
adm5120_router_le/	25-Aug-2010 23:58	-
ar7/	09-Aug-2010 08:10	-
ar7lxx/	25-Aug-2010 22:27	-
atheros/	26-Aug-2010 05:05	-
au1000/	26-Aug-2010 07:36	-
avr32/	09-Aug-2010 11:16	-
brcm-2.4/	09-Aug-2010 10:48	-
brcm47xx/	09-Aug-2010 16:29	-
brcm63xx/	09-Aug-2010 17:20	-
cobalt/	22-Jul-2010 22:46	-
ep80579/	27-Aug-2010 07:34	-
ifxmips/	26-Aug-2010 07:18	-
ixp4xx/	26-Aug-2010 13:58	-
kirkwood/	23-Jul-2010 02:18	-
octeon/	26-Aug-2010 18:37	-
orion/	09-Aug-2010 18:46	-
ppc40x/	10-Aug-2010 00:20	-
ppc44x/	09-Aug-2010 23:56	-
rb532/	27-Aug-2010 00:24	-
rdc/	09-Aug-2010 21:35	-
x86/	27-Aug-2010 07:34	-
xburst/	23-Jul-2010 04:31	-

OpenWRT

Preparação e instalação do OpenWrt

bin (kernel e sistema de arquivos juntos), a partir do firmware original;

trx (kernel e sistema de arquivos juntos) upgrade OpenWrt;

Ou (equipamentos mais antigos Dir-300, WRT54G)

Izma (imagem do kernel)

squashfs (sistema de arquivos)

Verificar na página do OpenWRT específica do equipamento qual procedimento de flash funcionará!

Exemplos

- Mesmo faricante, diferentes dificuldades
 - Dir-300 x Dir-615
 - Redboot x Uboot
- Mesmo modelo, diferentes possibilidades
 - Linksys WRT54G (Ver. 1-4 X 5-8)
 <>s flash e ram principalmente

Flash do Dir-615

Safemode web (<http://...>)

Ligar com reset pressionado até led Power começar a piscar

Host local 192.168.0.2 - definido manualmente

Acessar via navegador 192.168.0.1

Subir o novo arquivo [.bin](#)

Reiniciar e logar :D

Flash do Dir-300

conectar porta wan

```
##Script acesso ao boot-loader  
#!/bin/bash  
  
host="192.168.20.81"  
  
while true  
do  
    if eval "ping -c 1 -s 1 $host" > /dev/null; then  
        putty telnet://$host:9000 -m ctrlc.txt  
        break  
    else  
        sleep 1  
    fi  
done
```

Flash do Dir-300 - carregando a ram

Waiting for Redboot to boot. Press CTRL + C to quit

Router Awake

Trying 192.168.20.81...

Connected to 192.168.20.81.

Escape character is '^]'.

RedBoot>

RedBoot> load ap61.ram

Using default protocol (TFTP)

Entry point: 0x800410bc, address range:
0x80041000-0x800680d8

RedBoot> go

Connection closed by foreign host.

Flash do Dir-300 - carregando a rom

```
gnu:/usr/tftp# telnet 192.168.1.1 9000
Trying 192.168.1.1...
Connected to 192.168.1.1.
Escape character is '^]'.
DD-WRT> fis init
About to initialize [format] FLASH image system -
continue (y/n)? y
*** Initialize FLASH Image System
... Erase from 0xbffe0000-0xbffff0000: .
... Program from 0x80ff0000-0x81000000 at 0xbffe0000: .
DD-WRT>
Confirmando endereço ip do micro.
DD-WRT> ip_address -h 192.168.1.2
IP: 192.168.1.1/255.255.255.0, Gateway: 0.0.0.0
Default server: 192.168.1.2
Carregando a rom de inicialização.
```

Flash do Dir-300 - gravando a rom

```
DD-WRT> load -r -b %{FREEMEMLO} ap61.rom
Using default protocol (TFTP)
Raw file loaded 0x80080000-0x800a8717, assumed entry at
0x80080000
```

```
DD-WRT> fis create -l 0x30000 -e 0xbfc00000 RedBoot
An image named 'RedBoot' exists - continue (y/n)? y
... Erase from 0xbfc00000-0xbfc30000: ...
... Program from 0x80080000-0x800a8718 at 0xbfc00000: ...
... Erase from 0xbfffe0000-0xbffff0000: .
... Program from 0x80ff0000-0x81000000 at 0xbfffe0000: .
DD-WRT> reset
```

Agora você já trocou o boot loader do roteador! Resta ainda subir e gravar as imagens LZMA e SQUASHFS... Na comunidade <http://softwarelivre.org/rede-mesh> há um manual detalhado!!!

Caso Linksys WRT-54G

- WRT54G aparece no mercado com duas versões de hardware para mesmo modelo
- ver(1-4) mem. flash **4mb**, permite OpenWRT
- ver(5-8) mem flash **2mb**, só DD-Wrt micro...

Busy Box – built in commands

```
BusyBox v1.11.2 (2009-09-06 01:23:20 UTC) built-in shell (ash)
Enter 'help' for a list of built-in commands.
```

```
| |-----| .-----|-----| | |-----| |-----| | | | | | | | | | |
| - || - | -_|| | | | | | | | | | | | | | |
|-----|| | _|| | | | | | | | | | | | | | |
| | | W I R E L E S S F R E E D O M
```

```
KAMIKAZE (8.09.2-RC2, r17574) -----
```

```
* 10 oz Vodka      Shake well with ice and strain
* 10 oz Triple sec mixture into 10 shot glasses.
* 10 oz lime juice Salute!
```

```
-----  
root@OpenWrt:~# help
```

```
Built-in commands:
```

```
-----  
. : [ [[ alias bg break cd chdir command continue echo eval exec  
exit export false fg getopt hash help jobs kill let local printf  
pwd read readonly return set shift source test times trap true  
type ulimit umask unalias unset wait
```

```
root@OpenWrt:~# █
```

mais estes

:O

80211stats	firstboot	sh	sort
[free	luci-reload	ssh
[[gpiocctl	madwifi_multi	start-stop-daemon
arping	grep	md5sum	strings
ash	gunzip	mesg	swconfig
ath_info	gzip	mkdir	switch_root
athchans	halt	mkfifo	sync
athkey	head	mknod	sysctl
athstats	hexdump	mktemp	syslogd
awk	hostapd	mount	sysupgrade
basename	hostid	mount_root	tail
brctl	hotplug-call	mtd	tar
bunzip2	hotplug2	mv	tee
busybox	httpd	nc	telnet
bzcat	hwclock	netmsg	telnetd
cat	id	netstat	test
chgrp	ifconfig	nice	time
chmod	ifdown	nslookup	top
chown	ifup	opkg	touch
chroot	init	passwd	tr
clear	insmod	pgrep	traceroute
cp	ipcalc.sh	pidof	true
crond	iptables	ping	uci
crontab	iwconfig	ping6	udevtrigger
cut	iwgetid	pivot_root	udhcpc
date	iwlist	pkill	umount
dbclient	iwpriv	poweroff	uname
dd	iwspy	pppd	uniq
df	kill	printf	uptime
diff	killall	ps	usb-storage
dirname	killall5	pwd	uvl
dmesg	klogd	rdate	uvlc
dnsmasq	led.sh	reboot	vconfig
dropbear	length	reset	vi
dropbearkey	less	rm	watchdog
du	ln	rmdir	wc
echo	lock	rmmod	wget
egrep	logger	route	which
env	login	scp	wifi
expr	logread	sed	wlanconfig
false	ls	seq	xargs
fgrep	lsmod	sh	yes
find	lua	sleep	zcat

OpenWRT - configurações básicas

1o login via telnet para troca de senha do root.

The screenshot shows the OpenWrt web interface. At the top, the OpenWrt logo is displayed with the slogan "Wireless Freedom". To the right, system information is shown: "OpenWrt Firmware Backfire (r22752)", "Load: 0.08 0.02 0.01", and "Hostname: OpenWrt". Below this, there are two tabs: "Administration" and "Essentials". The main content area has a title "Authorization Required" and a message "Please enter your username and password." It contains two input fields: "Username" with "root" and "Password" with a masked value. At the bottom right of the form are "Reset" and "Login" buttons. The background features a silhouette of a city skyline. At the very bottom, it says "Powered by LuCI 0.9 Branch (v0.9+svn6240)" and "Done". On the far right, there's a status bar with a red signal icon, a blue network icon, and the text "Local network 192.168.1.1".

OpenWRT – ativar placa wifi

Overview Status System Services Network Changes: 0 **Administration Essentials**

Hello!

Interfaces WiFi Switch DHCP Hostnames

This is the administration interface for configuring OpenWrt Kamikaze.

LuCI is a free, flexible graphical interface for configuring OpenWrt Kamikaze. On the following pages you can change important settings of your router.

Notice: In LuCI changes will be saved by clicking Changes - Save & Apply below.

As we always say: And now have fun!

The LuCI Overview Status System Services Network Changes: 0 Administration Essentials

OpenWrt Wireless Freedom

Networks

You can run several wifi networks with one device. Be aware that there are certain hardware and driverspecific restrictions. Normally you can operate 1 Ad-Hoc or up to 3 Master-Mode and 1 Client-Mode network simultaneously.

Device wifi0

Overview	<input type="checkbox"/>
enable	<input checked="" type="checkbox"/>
Type	atheros
Channel	11 (2.462 GHz)
Transmit Power	10 dBm
Mode	auto
Diversity	<input type="checkbox"/>
Additional Field <input type="button" value="Add"/>	

Interfaces

ESSID	NOME	<input type="checkbox"/> Remove entry
Network	Ian	<input type="checkbox"/> Add the Wifi network to physical network
Mode	Access Point	
Encryption	WPA-PSK/WPA2-PSK Mixed Mode	
Key	*****	
Additional Field <input type="button" value="Add"/>		<input type="button" value="Add entry"/>

Powered by LuCI 0.9 Branch (v0.9+svn6240)

OpenWRT – Múltiplas wifis

The screenshot shows the OpenWrt LuCI web interface for managing wireless networks. At the top right, system information is displayed: OpenWrt Firmware, Kamikaze (r18961), Load: 0.04 0.04 0.01, and Hostname: OpenWrt. Below this, a navigation bar includes links for Overview, Status, System, Services, Network (which is highlighted in yellow), Administration, and Essentials. The main content area is titled "Wifi" and contains two sections: "Networks" and "Create Network".

Networks

Link	ESSID	BSSID	Channel	Protocol	Mode	Encr.	Power	Scan
0/70	pub	06:22:B0:41:3A:91	1		ap	none	17 dBm	Scan
0/70	comuna	00:22:B0:41:3A:91	1		ap	psk2	17 dBm	Scan

Create Network

Device:

Powered by LuCI 0.8.8 Release (v0.8.8)

E MUITO MAIS!!!!

referências

- Wireless Networking in the Developing World – <http://wndw.net>
- GT Mesh UFF: <http://mesh.ic.uff.br/>
- Cataluña: <http://guifi.net>
- Buenos Aires: <http://www.buenosaireslibre.org/>
- <http://www.wlanbook.com/wireless-access-point-router-autopsy/>
- <http://www.guiadohardware.net/tutoriais/alcance-antenas-conectores-potencia/pagina2.html>

Obrigado!

<http://softwarelivre.org/rede-mesh>



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