OpenWRT - embedded Linux for wireless routers

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Outline

ISO 1131/IBM 001

Disclaimer:

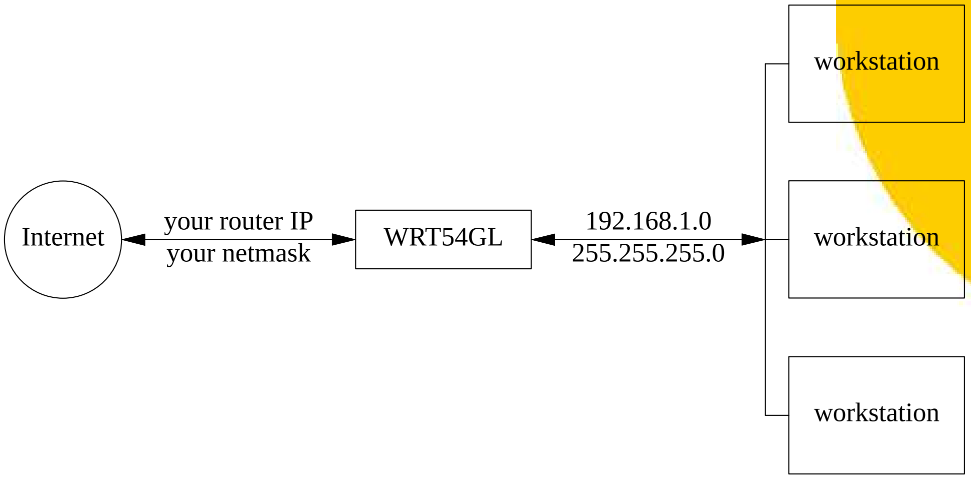
- Not an OpenWRT designer or developer
- There’s more than one way to do it

Outline

- Big Picture
  - OpenWRT
  - Linksys WRT54GL
  - networking
- Practical Stuff
  - buying
  - flashing
  - what you get
  - how to get more
- Example: my home network

Role of the Router

30,000 foot view



Default OpenWRT setup

- router does address translation for hosts
- can forward service requests to servers
- allocates local IP
- answers DNS queries

OpenWRT

I’ve called you all here...

Embedded Linux for wireless routers

- Full command-line environment, but lean
- Appropriate device drivers
- WWW interface for simple configuration

Why screw around with flash on my router??

- Tweak the service configuration
  - firewall
  - local DNS
  - DHCP
- Get more out of the hardware
  - signal strength
  - afterburner
  - VLAN switch - DMZ

Linksys WRT54GL

Let’s talk about hardware...

CPU/Filesystem resources

- Broadcom 5352 200Mhz
- RAM 16 MB
- Flash 4 MB

Networking

- Wireless interface (including "afterburner")
- Ethernet bridge (bridges to wireless)
- VLAN switch

Other Hardware: http://wiki.openwrt.org/TableOfHardware

Important Safety Tip

The L is very important

The WRT54G (not GL) is much less capable:

- 2 MB RAM 8 MB flash
- VxWorks OS
- very brickable

New from Amazon

- WRT54G: $49.99
- WRT54GL: $64.99
- WRT54GS: $69.99
- WRST54GS: $99.99 - USB!

The Innards of the WRT54GL

Mmmmm. Block diagram

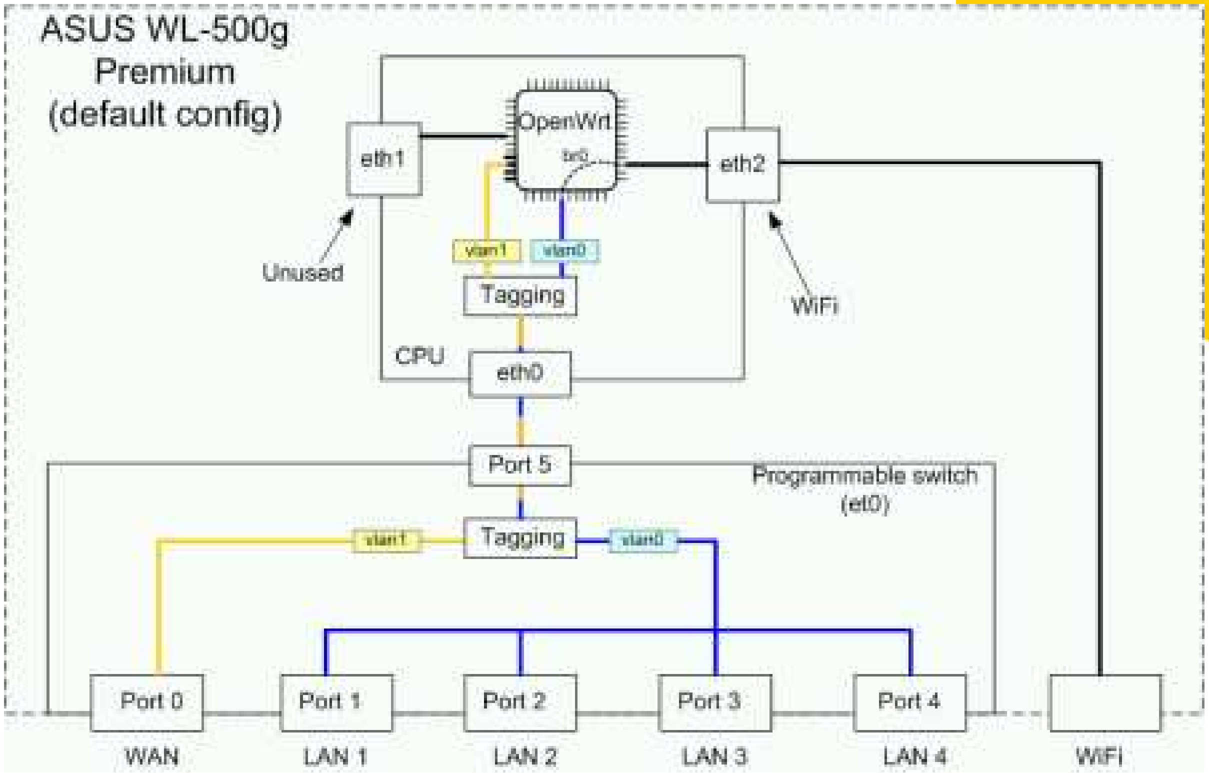


Image from http://wiki.openwrt.org/OpenWrtDocs/NetworkInterfaces

VLANs and a DMZ

What are VLANs for?

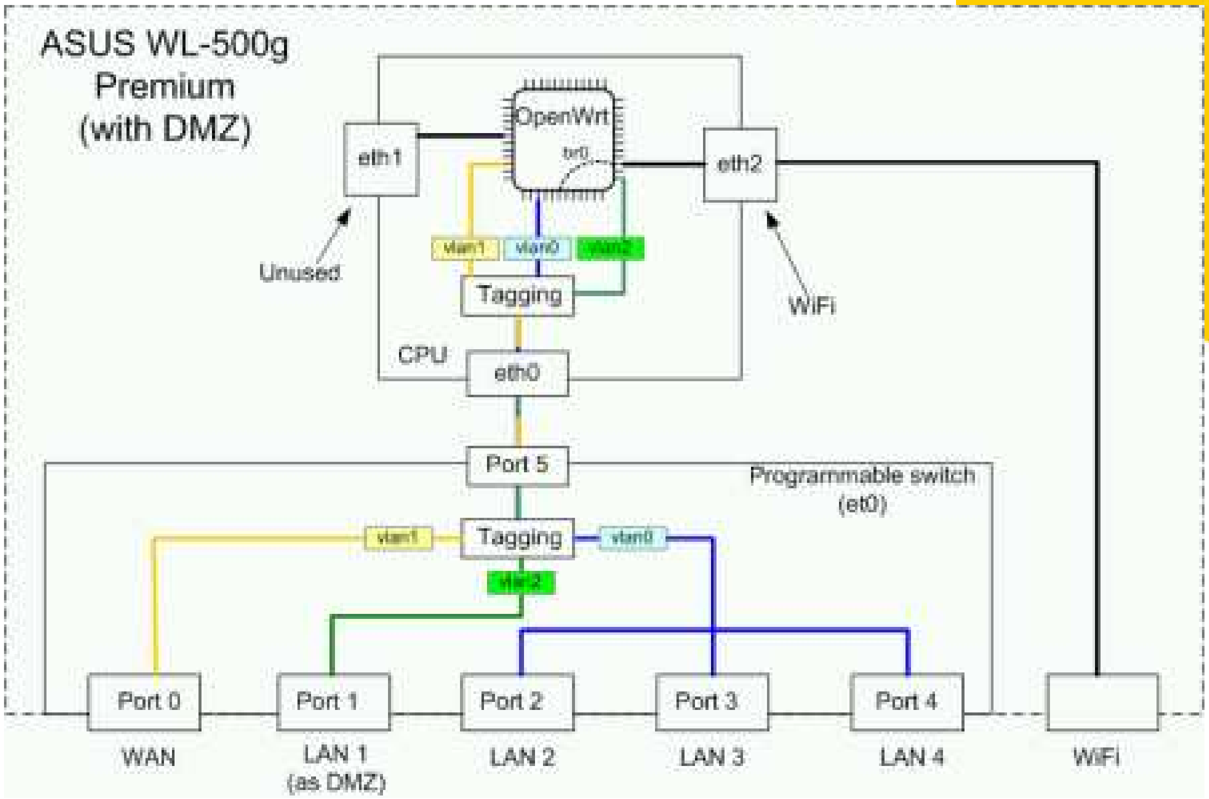
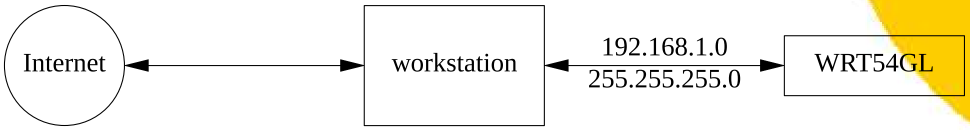


Image from http://wiki.openwrt.org/OpenWrtDocs/NetworkInterfaces

Network setup

don’t burn any bridges...



Router lives on 192.168.1.1
Firewall rules to router open
Hooked to Internet for packages

Flashing the Firmware (WRT54GL)

it's this easy

Default webserver on 192.168.1.1:80

- user: admin password: admin

Download the right firmware

- http://downloads.openwrt.org/whiterussian/newest/
  - WRT54GL: default/openwrt-wrt54g-squashfs.bin
  - WRT54G: micro/openwrt-wrt54g-squashfs.bin
  - upgrade: openwrt-brcm-2.4-squashfs.trx

Choose "the update the firmware" option from the web server

- take a short walk - do not disturb

Other choices: TFTP, JTAG...

After the flash

initial housekeeping

- Telnet (!) in and set a root password
  - initial install - no password
  - later boots will disable telnet
- Ssh server in place
  - add ssh2 keys into /etc/dropbear/authorized hosts
- Set boot_wait for safety
- Can config a lot from the web server
  - including all this

What comes with the default install

out of the box

Linux 2.4.30 kernel

Utilities

- busybox
- telnet (but make sure it’s off)
- dropbear (ssh server)
- iptables (firewalling, NAT configuration)
- dnsmasq (DNS and DHCP on the 192.168.1.0 subnet, LAN port)
- udhcpc (busybox, WAN port)

Extensions

a little nuts on your vanilla

Extra packages:

- ipkg tool (std install)
- http://downloads.openwrt.org/whiterussian/packages/
- probably need http proxy

Compliling OpenWRT or packages

- http://wiki.openwrt.org/BuildingPackagesHowTo
- debian environment
- cross compile
- FreeBSD ports/Gentoo packages style

Linux on the OpenWRT

tech weenie stuff

Filesystems

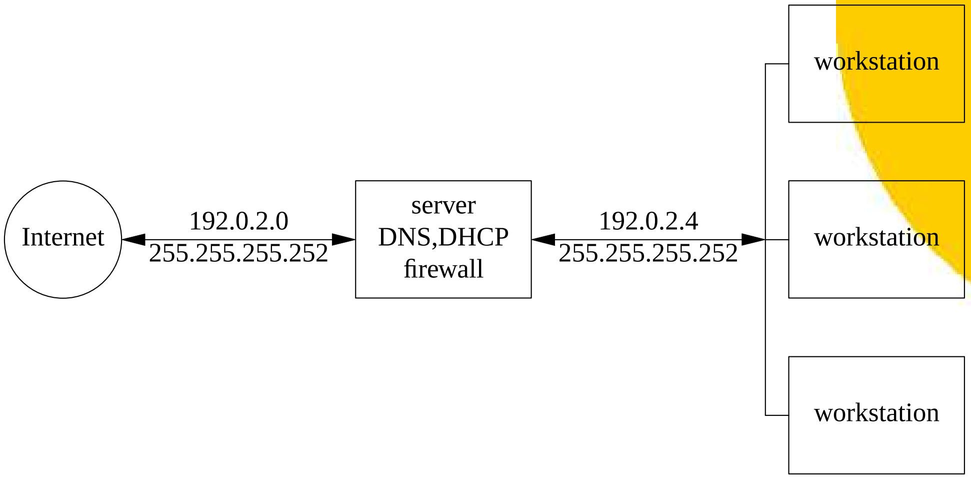
- /rom - read only files
- /tmp - memory file system
- /jffs2 - journalling flash file system
- mini_fo mitigates between jffs and rom (firstboot restores orig)

NVRAM (last 64K of flash)

- configuration options
  - scripts
  - commands
  - hardware config (VLANs & interfaces)
- nvram command manipulates this

Example: My Home Network

where the heart is

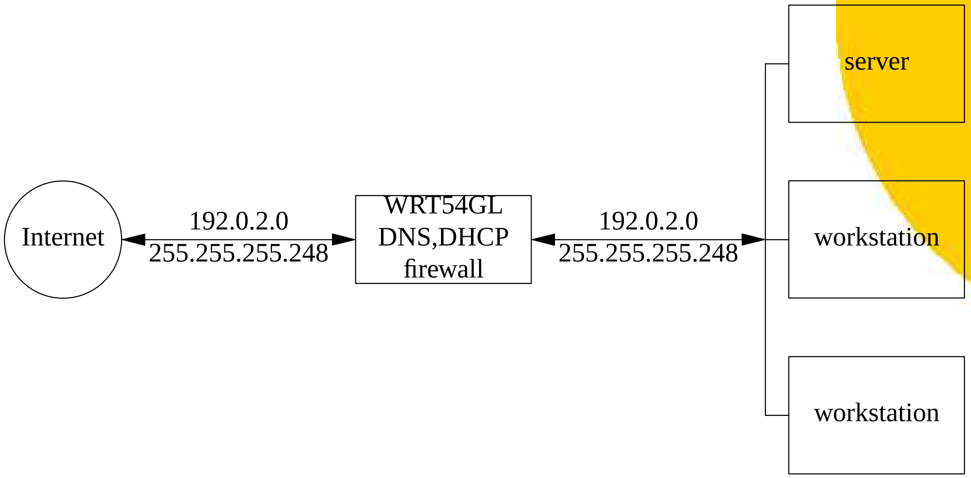


Server a choke point/my desktop
Wasted addresses in firewall
ISP believes we’re 1 happy subnet (proxy arp)

192.0.2.0 is the example subnet from RFC 3330, not my home net

A Better Tomorrow

openWRT to the rescue



Non-servers work if server down

Extra IP address

ISP believes we’re 1 happy subnet (proxy arp)

Plan - disable everything and build back up

Step 1: addresses and routing

getting packets in place

http://www.sjdjweis.com/linux/proxyarp/

Doing it

- Set addresses of WAN and LAN (WEP as well) using nvram
- Set proxy ARP on for ISP side (kernel feature!)
- iproute2
  - install with ipkg
  - set up routing with same address on 2 interfaces

Put it all (except nvram) into /etc/init.d/S80bridge

Step 2: Firewall

protecting the home front

http://wiki.openwrt.org/OpenWrtDocs/IPTables

Edits to /etc/user.firewall

- disable host masquerading (NAT)
- add rules to allow local services on WRT54GL
  - NTP
  - DNS
- add rules for services on server
- default allows connections out

Step 3: DHCP and DNS

2 features, 1 program (dnsmasq)

http://wiki.openwrt.org/OpenWrtDocs/dnsmasq

DHCP

- override standard script completely
  - too helpful
- set to hand out my local addresses
  - timeouts, addresses, default routes, DNS servers, domain

DNS

- front end to my DNS and ISP DNS

Edits are to /etc/dnsmasq.conf

Step 4: Time Setting

just to be a weenie

http://wiki.openwrt.org/OpenWrtDocs/Configuration

Get ntpclient using ipkg

Write script to call

- default setup failed due to my topology

Add cron call

That’s it!

fun, fast, easy

http://wiki.openwrt.org/
http://www.openwrt.org/

Docs are good
Any time you touch firmware be patient
Fun little box that lets you explore networking