Braga Geek Nights
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OpenWrt

a whole world in 4mb

presentation & photos:
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```
 ______                    _______       __
|      |.-----.-----.-----.|  |  |  |.----.|  |_
|  -   ||  _  |  -__|     ||  |  |  ||   _||   _|
|______||   __|_____|__|__||________||__|  |____|
         |__| W I R E L E S S   F R E E D O M
 KAMIKAZE (8.09, r18437) ----------------------------
  * 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:~#
```

OpenWrt: a whole world in 4mb

- *"Damn small" and light: everything is stripped-down*
- *"A whole world":*
  networking, audio, bluetooth, printing, etc.
- *Nice community (despite bad documentation!)*
- *Common architectures: Broadcom, Atheros, x86, etc.*
- *Many forks: FreeWRT, Freifunk, Coova, DD-WRT (?), ...*

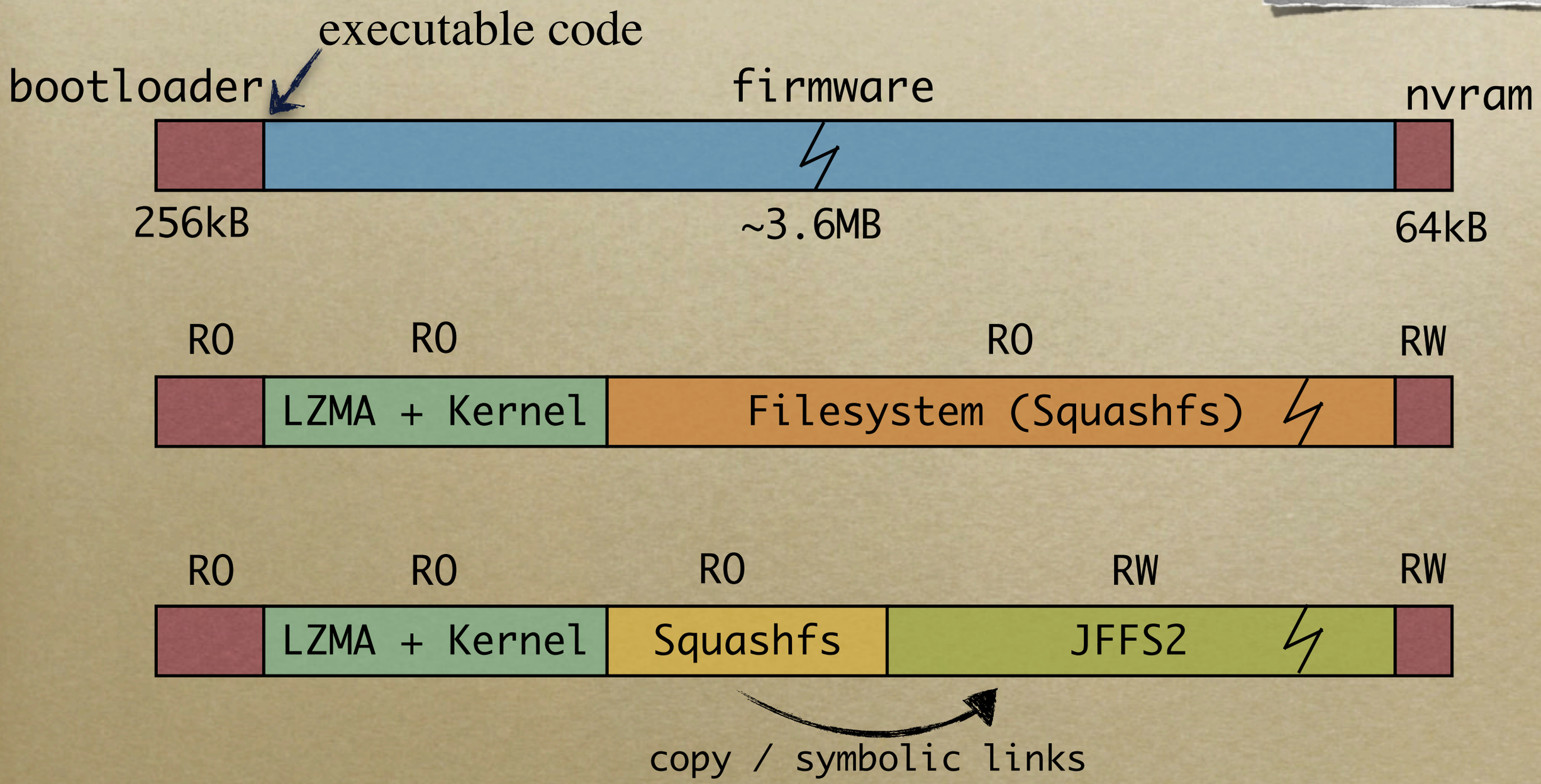
history

- ***2003.*** *Linksys releases the WRT54G*
  seattlewireless.net #wrt54g
  people start hacking on the firmware
- ***2005.*** *White Russian RC1*
- ***2007.*** *White Russian 0.9 final*
- ***2007.*** *Kamikaze 7.06*
- ***2009.*** *Kamikaze 8.09*

quick play

- *small boot firmware (press reset during power on)*
- *upload firmware (*.bin / *.trx) via TFTP*
- *wait for router to restart*
- `telnet 192.168.1.1`
- `passwd`
- `ssh root@192.168.1.1`

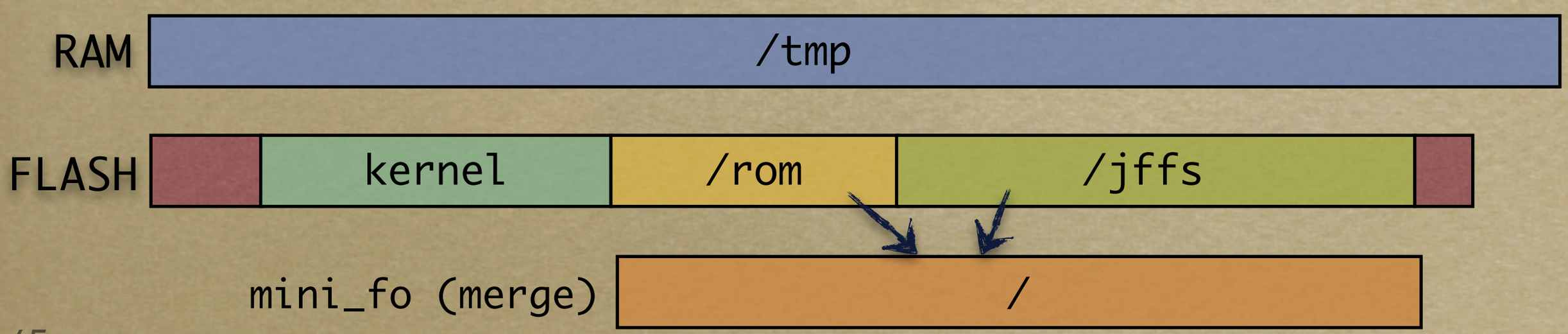
memory



More info at http://nuwiki.openwrt.org/oldwiki/Devel/FlashLayout

memory

```
root@OpenWrt:~# df -h
 Filesystem                Size      Used Available Use% Mounted on
 rootfs                    1.3M      1.3M         0 100% /
 /dev/root                 1.3M      1.3M         0 100% /rom
 tmpfs                    14.9M    300.0k      14.6M   2% /tmp
 /dev/mtdblock/4           5.9M      2.7M       3.3M  45% /jffs
 mini_fo:/jffs             1.3M      1.3M         0 100% /
```



configuration

- *White Russian (variables in NVRAM)*

```
$ nvram get wan_ipaddr
$ nvram set lan_ipaddr = ‘192.168.1.1’
$ nvram commit
```

- *Kamikaze (variables in files:* `uci`*)*
  - *structured in a tree*

```
$ uci get network.lan.ipaddr
$ uci set network.lan.ipaddr = ‘192.168.1.1’
$ uci set wireless.wifi-iface.ssid = ‘OpenWrt’
$ uci commit
```

configuration

```
$ uci show | grep network
 network.eth0 = 'switch'
 network.eth0.vlan0 = '0 1 2 3
 network.lan = 'interface'
 network.lan.type = 'bridge'
 network.lan.ifname = 'eth0'
 network.lan.proto = 'static'
 network.lan.ipaddr = '192.168
 network.lan.netmask = '255.25
 network.wan = 'interface'
 network.wan.ifname = 'eth1'
 network.wan.proto = 'dhcp'
```

```
$ ls /etc/config/
 dhcp        firewall    httpd       ntpclient
 wireless    bluetooth   dropbear    fstab
 network     system

$ cat /etc/config/network
config 'switch' 'eth0'
        option 'vlan0' '0 1 2 3 4 5u'
config 'interface' 'lan'
        option 'type' 'bridge'
        option 'ifname' 'eth0'
        option 'proto' 'static'
        option 'ipaddr' '192.168.1.1'
        option 'netmask' '255.255.255.0'
config 'interface' 'wan'
        option ifname eth1
        option proto dhcp
```

package management

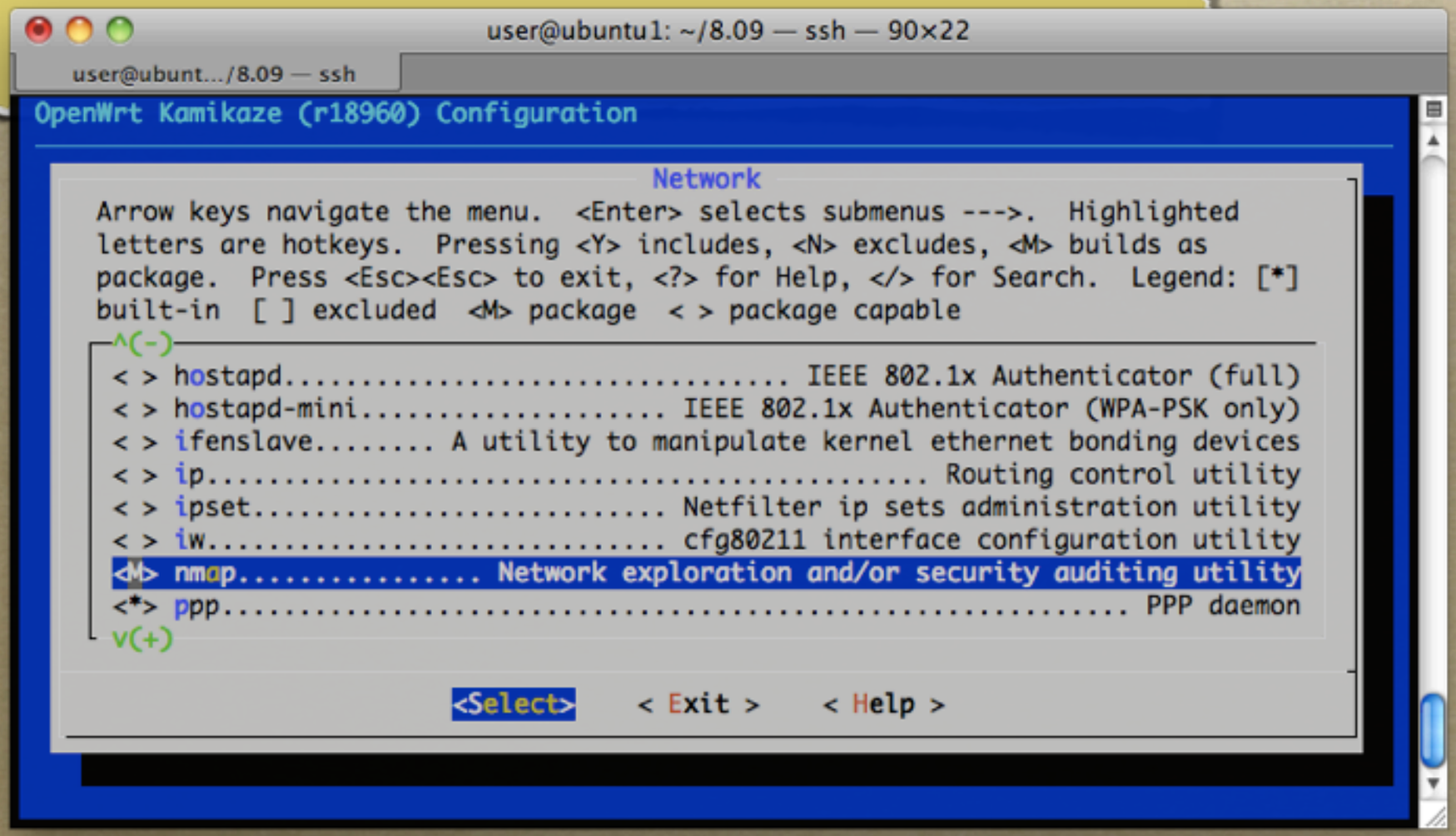
- *ipkg/opkg with .ipk files*

```
$ opkg update
  ...
  Updated list of available packages in /var/opkg-lists/snapshots


$ opkg list | grep nmap
  nmap - 4.20-1 - A free open source utility for network exploration
or security auditing.


$ opkg install nmap
  Downloading http://downloads.openwrt.org/kamikaze/8.09/brcm-2.4/
packages/./nmap-5.20.ipk
  ...
```

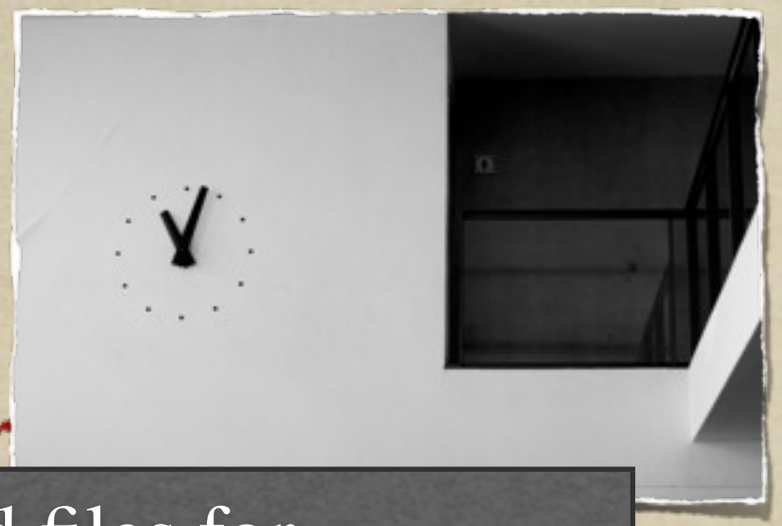
cross-compiling

```
$ svn co svn://svn.openwrt.org/openwrt/trunk kamikaze
$ scripts/feeds install nmap
$ make menuconfig
$ make
```

example for “nmap”



cross-compiling



	Makefiles and/or associated files for...
`tools`	...tools to build the firmware image *(e.g. bison)*
`toolchain`	...software related to the cross-compilation toolchain *(e.g. uClibc, gcc, binutils, kernel-headers, etc)*
`package *`	...user-space tools available to the target system. Contains the build-root makefiles. *(e.g. iptables, ppp, uci, bluez)*
`target`	...generation of target system image and linux kernel for the different system on a chip boards
`dl`	Each package source downloaded (tar.gz) is stored here.
`build_dir`	Where the source (tar.gz) is extracted and compiled. Contains the real makefiles.
`bin *`	The final output of the firmware (*.bin/*.trx) and the packages (*.ipk).

cross-compiling

- *Essential directories/files*

  example: compiling Nmap for Linksys (MIPS):

  - `package/nmap/Makefile`
  - `package/nmap/patches/`
  - `package/nmap/files/`
  - `dl/nmap-5.20.tar.gz`
  - `build_dir/mipsel/nmap-5.20/`

```
$ make menuconfig
    * (kernel): on firmware
    M (modules): on a package (.ipk)
```

- *Output:*

  - `bin/openwrt-wrt54g-squashfs.bin`
  - `bin/packges/mipsel/nmap-5.20-brcm-2.4-1_mipsel.ipk`

cross-compiling

- **Package/nmap -** Describes the package the menuconfig and ipkg entries.
- **Package/nmap/conffiles -** A list of config files installed by this package, one file per line.
- **Build/Prepare -** A set of commands to unpack and patch the sources
- **Build/Configure -** Contains all environment variables that are passed to ./configure
- **Build/Compile -** Contains all environment variables that are passed to the make command
- **Package/nmap/install -** contains the list of files to be included on firmware/package

cross-compiling

```
$ cat package/nmap/Makefile
 PKG_NAME:=nmap
 PKG_VERSION:=4.20
 PKG_RELEASE:=1

 PKG_SOURCE:=$(PKG_NAME)-$(PKG_VERSION).tar.bz2
 PKG_SOURCE_URL:=http://download.insecure.org/nmap/dist
 PKG_MD5SUM:=ea50419f99472200c4184a304e3831ea

 define Package/nmap
   SECTION:=net
   CATEGORY:=Network
   DEPENDS:=+libdnet +libpcap +libpcre +uclibcxx
   TITLE:=Network exploration and/or security auditing utility
   URL:=http://www.insecure.org/nmap/
 endef

 (...)
```

cross-compiling

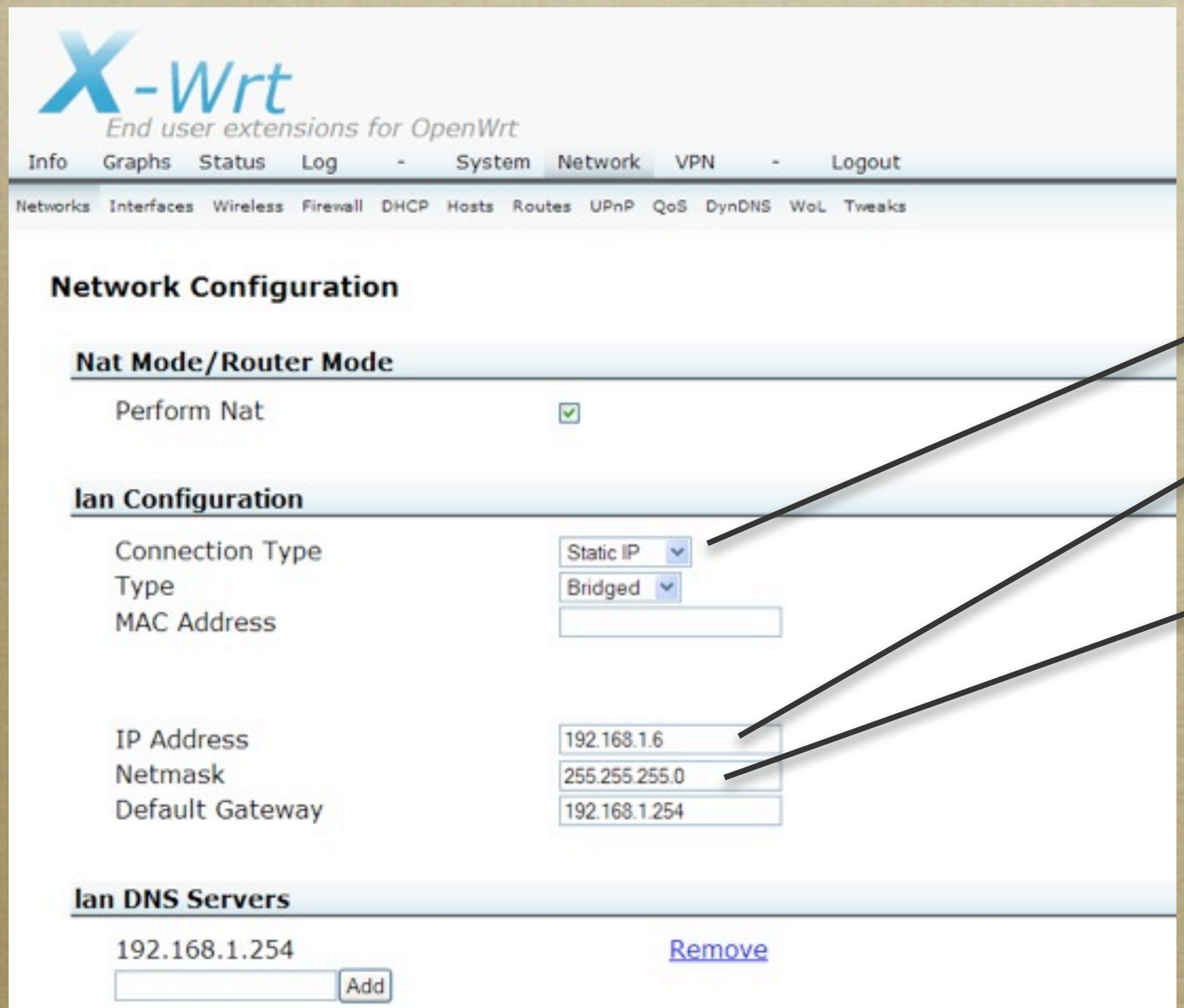
```
(...)
define Build/Configure
	$(call Build/Configure/Default, \
		--disable-pthread \
		--disable-debug \
		--disable-plugins \
		--enable-management \
		--disable-socks \
		--enable-password-save \
		,\
		ac_cv_func_epoll_create=no \
	)
endef

define Build/Compile
	$(MAKE) -C $(PKG_BUILD_DIR) \
		DESTDIR="$(PKG_INSTALL_DIR)" \
		all install
endef

define Package/nmap/install
	$(INSTALL_DIR) $(1)/usr/bin
	$(INSTALL_BIN) $(PKG_INSTALL_DIR)/usr/bin/nmap $(1)/usr/bin/
	$(INSTALL_DIR) $(1)/usr/share/nmap
	for file in mac-prefixes os-fingerprints protocols rpc service-probes services; do \
		$(CP) $(PKG_INSTALL_DIR)/usr/share/nmap/nmap-$$$$file $(1)/usr/share/nmap/ ; \
	done
endef
```

graphical user interface

- *Two different projects*
  - *X-Wrt Project (webif and webif^2)*
  - *LuCI (uses Lua language and follow MVC pattern)*
- *Offers a GUI for a lot of packages/tasks:*

  `system, packages, interfaces, bandwidth, umts, upnp, dyndns, wake-on-lan, routing, dhcp, netstat, iptables, usb, pppoe, pptp, openvpn, radius, asterisk, syslog, crontabs, backup configs, firmware upgrade, etc.`

graphical user interface




```
$ uci get ...
```

network.lan.proto

network.lan.ipaddr

network.lan.netmask

graphical user interface

Info | Graphs | Status | Log | - | System | Network | HotSpot | Freeloader | VPN | - | Logout

System | Modules | Processes | Interfaces | Wireless | UMTS | DHCP Clients | Netstat | Iptables | QoS | USB | PPPoE | PPTP | Asterisk | OpenVPN | Diagnostics

UMTS/GPRS Status

Device Information

Information	Value
Product Manufacturer	Option N.V.
Model Information	GlobeSurfer ICON
IMEI and Serial Number	35XXXXXXXXXXXX,VP24XXXXXX
Product Revision	3.18.0Hd (Date: May 09 2006, Time: 10:36:41)
Hardware Revision	2.0
Network Locked	Yes
Customization	Not defined
Band settings	Dual band 900/1800 MHz (Europe)
Access Point Name	internet

Battery Status

Status	Not charging
Capacity	100%

Signal Quality

	Unreliable	Workable	Good	Excellent
	0..9	10..14	15..19	20..31
Signal Quality:				20
Power (dBm):				-73
	-113..-95	-93..-85	-83..-75	-73..-51

questions