ASUS WL-500gP on OpenWRT talking to a Toppy

CONTENTS

1 OBJECTIVES

- Connect the Toppy to an existing wireless LAN in order to transfer TAPs and recordings to and fro without trailing cables across the house
- Automate the daily feed of EPG data to the Toppy without leaving a PC turned on.

There are many choices of firmware for the various embedded devices but as an ardent open systems supporter I liked the sound of one with the word 'Open' in its title and it promised a tiny platform independent linux OS. The same firmware will run on most MIPS/Broadcom based routers e.g. ASUS, Linksys, Belkin, D-Link, Buffalo etc. The advantage is flexibility in that you can build a system with exactly what you want in it and nothing else, but consequently you get very little ready made. Unlike most other firmware options, its footprint is small enough to get rt2mei up and running without requiring any external memory or disk.

The other main contender is Oleg's firmware, which is based on the original GPL router firmware with additional features. It is well documented for a Toppy setup and will almost certainly be simpler to setup and provide more features as standard. However I believe it only works on the ASUS WL-500 series routers and does require at least a USB flash drive to run rt2mei.

My home wireless LAN is provided by a Netgear DG384GT Wireless ADSL router. Because this does not support WDS, I was forced to configure the ASUS as a wireless client with routing between its LAN switch[1] and the wireless side rather than the conventional bridged solution. This factor makes this setup a little more complicated. These instructions should still work for any existing wireless router at home, but could be simplified if the ASUS is intended to be your only router or if your existing router supports WDS.

The instructions should also still work in outline for any other OpenWRT supported router but you will have to adjust certain parts for hardware differences.

2 DISCLAIMER

An OpenWRT setup is not for the faint hearted and you really need to be pretty familiar with linux or unix system configurations. That means real configuration using the command line and editing files, not just filling in the GUI dialogs (sic).

I have produced this guide from my own experiences and there is no guarantee that it will work for you. Flashing your router with new firmware is inherently risky. You will quite rightly void your manufacturer warranty and could *brick*[2] your router. You may use this document at your own risk and I accept no responsibility for any consequences. Naturally if you are successful I am more than willing to accept the credit, although the real credit should go to the writers and maintainers of OpenWRT and the various utilities, guides and forums that I browsed to get this far.

[1] The wired LAN is probably irrelevant to most people beyond its use for configuring the ASUS, but it can offer some wired LAN ports in your TV room if that's any use.
[2] Make it permanently inoperable. i.e. turn it into a brick.

3 PREREQUISITES

3.1 Essential

- A Toppy with a USB port (e.g. TF5800PVR)
- An ASUS WL-500gP (P=Premium)
- Another working wireless router (probably providing your home Internet connection)
- USB cable to the Toppy
- PuTTY ssh terminal emulator http://the.earth.li/~sgtatham/putty/latest/x86/putty-0.59-installer.exe (Windows) or any linux ssh e.g. OpenSSH
- OpenWRT 0.9 firmware image - http://downloads.openwrt.org/whiterussian/0.9/default/openwrt-brcm-2.4-squashfs.trx
- A TFTP client program. Win2000/XP has a good enough one built-in otherwise http://perso.wanadoo.fr/philippe.jounin/tftpd32.html (although you may need to brush up on your French) atftp apparently works well for linux.
- A wired networked PC/Laptop
- A working knowledge of the vi editor - enough to insert, replace, yank, put, write and quit.
- Lots of time

3.2 Desirable

- MyStuff TAP or other EPG using .mei files.
- Very preferably a second PC/laptop although this one can be wireless, and is only helpful during the first part of the setup.
- Some form of extra USB storage. e.g. USB flash drive or disk drive for making backups of the config etc. It is possible to fit everything required for rt2mei and ftpd-topfield in the standard ASUS memory, but you need more space if you want any bigger packages. If you want to transfer recordings onto the ASUS from the Toppy, you need to up-size appropriately and a disk is probably better. Note that as far as I know there is no reliable NTFS support under OpenWRT, although it can support ext2/ext3 for linux compatibility, for Windows compatability you need to format the drive as FAT32.
- A great deal of patience

The build process is possible with a single computer to talk to the ASUS but it will avoid much rebooting and NIC reconfiguring if you can have one PC on your home LAN (or WiFi) and another plugged into the switch of the ASUS. It is possible to achieve it with two NICs on a single PC, but sometimes it would not be obvious whether the routing was working via the home WiFi or the ASUS direct.

4 PLAN YOUR SUBNETS

In order to connect to a WiFi LAN which does not support WDS, you need to set the ASUS up as a wireless station and route between separate LAN and WIFI subnets. Choose any private subnet you like - this is what I chose. If your chosen subnets/addresses are different, then you will need to substitute them in the rest of this document.

Purpose	Subnet Address	Subnet mask	ASUS Address
Wired LAN on ASUS	`192.168.100.0`	`255.255.255.0`	`192.168.100.3`
Home WiFi Subnet	`192.168.99.0`	`255.255.255.0`	`192.168.99.3`

Choose a fixed IP addresses on each subnet for the ASUS that is compatible with your home LAN. Preferably make sure it is outside the range of addresses that any DHCP service might allocate on you existing router. For simplicity I prefer to make the last octet the same on both subnets. For example I allocated `192.168.99.3` on the WiFi side and `192.168.100.3` on the ASUS switch side, and I restricted the DHCP scope on both routers to be from 50-99.

5 TEST THE ASUS

Connect and power-up the ASUS as per the supplied documentation.

Try to get it running using the standard firmware and disconnected from your wired LAN first. Allocate a different subnet to your home subnet. Use the ASUS HTML UI to enter the WiFi and LAN parameters even if you can't get it to connect wirelessly. If you are currently running Oleg's, then the nvram values are probably reasonably OK already and you can skip this stage.

One setup that is known to work on a Netgear DG834G v2 (and may not work for v3) is as follows:

```
System Setup -> Operation Mode -> Access Point
Wireless -> Bridge -> Hybrid
Wireless -> Advanced -> Extended Mode -> Ethernet Bridge
```

If you manage to get access to your ASUS from other wireless nodes with encryption turned on, then you can probably avoid the messing about with routing, firewall etc. In this case, you may be OK to follow section 8.4 instead of the more complicated 8.5.38.5 (see note later).

6 SETUP THE PC(s)

Create entries in the hosts files[1] on any PCs which will be used to access the ASUS - e.g. `C:\Windows\System32\drivers\etc\hosts` on Win2K/XP or `/etc/hosts` under linux/unix

```
192.168.99.3      asus  asuswifi
192.168.100.3     asuslan
```

Configure a PC to have another non-clashing address on the ASUS Wired subnet (say 192.168.100.10) and plug it into any of the 4 ASUS LAN switch ports. If your PC is setup to use DHCP, you can just release and renew the PC's LAN interface or reboot the PC to get the ASUS to dish out an address via DHCP.

Leave the second PC (or NIC) connected to the existing WiFi router either directly or wirelessly so that it can reach the WiFi host(s).

Install PuTTY on the PCs then make sure your PATH is set up to find pscp and the other ssh tools from a command window. Under 2000/XP I think this is Right-click My Computer, Properties, Advanced, Environment Variables. Select 'Path' in the System variables pane and edit its value adding a semicolon and the path to the PuTTY install directory. E.g. `;C:\Program Files\PuTTY` Then press OK all the way out.

The default PuTTY config works well although from memory you may have to change the default action of the backspace key to generate Control-H

[1] Or in AD/Wins/DNS as appropriate to your network.

7 REFLASH THE ASUS

This is your last chance to preserve your manufacturer warranty. DO NOT PROCEED UNLESS YOU ARE PREPARED TO LOSE THIS.

Contrary to the general statements about OpenWRT on most routers, the ASUS WL-500 routers do not revert to the default 192.168.1.1 address when you start the bootloader. You can always connect to them on the last address you used (so don't forget it). If this does not work, then try the default address.

I think it is most reliable to install OpenWrt using a tftp client when the router is in *diag* mode. To put the router in *diag* mode, do this:

- Unplug the power on the ASUS.
- Press the black RESTORE (not the red EZsetup) button using a pen or matchstick.
- Plug the power back in while keeping the RESTORE button pressed in.
- Once you see a slowly blinking power light, you're in *diag* mode. Now the router should accept a firmware image via tftp.
- On the PC connected to the ASUS via wire[1], get to a command prompt and cd to the directory where the firmware file is.
- Type the following command:
  `tftp -i 192.168.99.3 put openwrt-brcm-2.4-squashfs.trx`
- The OpenWRT ASUS notes suggest that the ASUS does not reboot itself and advise you to wait 6 minutes then power-cycle it. In my experience it does reboot and is ready to accept a connection after this process. If you want to be cautious, wait 6 minutes anyway and then try to connect. Only reboot if you don't get a connection.

Start PuTTY and try to connect to the host called 'asuslan' using the Telnet protocol. Select it from the radio buttons below the hostname field. You should see a banner something like this:

```
BusyBox v1.00 (2007.01.30-11:42+0000) 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
 WHITE RUSSIAN (0.9) -------------------------------
  * 2 oz Vodka   Mix the Vodka and Kahlua together
  * 1 oz Kahlua  over ice, then float the cream or
  * 1/2oz cream  milk on the top.
 ------------------------------------------------
root@OpenWrt:~#
```

[1] Don't try to download firmware wirelessly even if your wireless is very reliable it's a recipe for bricking your router.

At the # prompt type:

```
passwd
```

And enter a new password (twice). This will disable telnet and enable ssh (more secure). Record this password somewhere safe then open another PuTTY and try to connect to asuslan using the ssh protocol this time. The login is `root` and the password is whatever you just set. If this also shows a banner like above, then all's well. Go back to the original telnet window and type:

```
exit
```

Which will close that session. From here on in you can only use ssh.

If it didn't work, use the original telnet window to try and diagnose the problem and/or redo the password. If all else fails, directly editing `/etc/passwd` and removing the encrypted password between the second and third semicolons will leave the telnet service operational while you try and resolve problems.

8 INITIAL UNENCRYPTED WIRELESS SETUP

8.1 Copy and Paste

From this point, you are going to have to type quite a few long commands. You may find it helpful to copy and paste between this document an the PuTTY window.

8.1.1 In Windows

Copying and pasting on the Windows side is by your normal preferred Windows method. E.g.

Select text with the left mouse button or shift-right-cursor, then control-c, right-click→copy, Edit→Copy etc.

Paste is Control-V, Right-click→Paste or Edit→Paste.

8.1.2 In PuTTY

In a PuTTY window, copying is usually achieved by just selecting with the left mouse button. It will end up in the Windows clipboard automatically.

Pasting a command using putty is by pressing the middle mouse button. If you only have two buttons then you can usually press both together to simulate that.

The PuTTY behaviour can be affected by the settings in Window→Selection.

To copy and paste between the two should be obvious, use the Windows copy and the PuTTY paste or vice-versa.

8.2 nvram values

Many of the core networking features are driven by settings stored in a table in the non volatile ram. These are accessed as follows:

```
nvram show | less              # Shows all values
nvram get name          # Shows a single value
nvram set name="value"  # Sets a value
```

To extract the whole lot and peruse it, try this:

```
nvram show | sort > /tmp/settings
vi /tmp/settings
```

8.3 memory availability

Apparently some routers (or some releases of OpenWRT) only reveal half their 32MbRAM by default. Mine was correct after flashing standard ASUS firmware and RC6 and 0.9 final. YMMV - Check the memory by running:

```
dmesg | grep Memory
```

A line like this means you have all the memory available:

```
Memory: 30436k/32768k available
```

If it shows about 16Mb then try:

```
nvram set sdram_init=0x0009
nvram set sdram_ncdl=0
```

8.4 WDS or Bridged Setup

If you were able to make the router connect with the standard firmware, then you may be able to avoid much of the complexity of a routed setup. In this case try the following which relies in the firmware settings left behind by the standard ASUS firmware, otherwise go straight for the routed setup.

```
nvram set wl0_akm=open
nvram commit
reboot
```

If bridged setup doesn't work after a bit of trying, then the Routed Setup should work for all cases.

8.5 Routed Setup

This should be the lowest common denominator which will work in all cases. However, it does mean that the LAN switch on the ASUS will need to be on a separate subnet from the Wireless side.

8.5.1 move WiFi to separate vlan

Remove wifi from LAN bridge br0:

```
nvram set lan_ifnames=vlan0          # Just the 4 port switch
```

Setup wireless device as eth2 if not already (White Russian RC6 sets it to eth1 which is correct for earlier WL-500gDeluxe, but not Premium). I think it's fixed in 0.9 final but I had already reconfigured mine under RC6 so I can't be sure.

```
nvram set wan_ifname=eth2          # Make the wan point at WiFi
nvram set wan_device=eth2          # May be unnecessary
nvram set wl0_ifname=eth2          # May be unnecessary
```

I don't think the bridge br0 is useful in itself, but haven't been able to test removing it completely without committing nvram and I am afraid of bricking the router. I may try this once I am convinced I can only break the LAN side.

If you intend to use the router LAN, you can include the port labelled WAN so you get 5 ports. It is fundamentally the same as the other ports and only differentiated by vlan. I haven't tried this myself, but it should work by changing these values, which moves port 0 from vlan1 to vlan0.

```
nvram set vlan0ports="0 1 2 3 4 5*"
nvram set vlan1ports=5
```

8.5.2 routing

Set gateway and DNS to your WiFi router.

```
nvram set wan_proto=static
nvram set wan_ipaddr=192.168.99.3          # ASUS address
nvram set wan_netmask=255.255.255.0
nvram set wan_gateway=192.168.99.1         # Existing router
nvram set wan_dns=192.168.99.1             # Existing router
```

8.5.3 wifi config

Set wifi params wireless mode as sta (client station), leave encryption off at first

```
nvram set wl0_mode=sta
nvram set wl0_akm=open
nvram set wl0_ssid=<your SID/SSID/ESSID>
nvram commit
reboot
```

Wait for the ASUS to reboot, restart PuTTY and log back in.

If you can ping www.google.com, it's looking good.

9 BACKUP CONFIG USING SSH

You should make a backup at key stages in case something makes the router unresponsive. My impression is that for practical purposes, you can't truly *brick* the router unless you are linking your own firmware images. You should be able to recover using the TFTP method although a serious cock-up with the nvram settings may mean you have to reflash to the original ASUS firmware by this method before putting OpenWRT back on.

9.1 Backup

firmware image:

```
mount -o remount,ro /dev/mtdblock/4 /jffs
dd if=/dev/mtdblock/1 > /tmp/first_config[1].trx
mount -o remount,rw /dev/mtdblock/4 /jffs
dd if=/dev/mtdblock/3 > /tmp/first_config.nvram
```

nvram, package list and /etc/config files as a compressed tar:

```
nvram show | sort >/etc/nvram.save  # Can take quite a few seconds
cd /
tar cvf - usr/lib/ipkg/status etc |
    gzip -c >/tmp/first_config.tgz
```

Then, from the PC, make sure your PATH is set up to find pscp, then open a command window, cd to the directory where you want to store the backups and then fetch them:

```
pscp -unsafe -scp "root@192.168.3.99:/tmp/first_config.*" .
```

Note the trailing full stop in the above command - it is important.

9.2 Restore (untested)

From PC:

```
pscp -scp first_config.* root@192.168.3.99:/tmp
```

From ASUS, firmware image:

```
dd if=/tmp/first_config.nvram of=/dev/mtdblock/3
mount -o remount,ro /dev/mtdblock/4 /jffs
mtd -r write /tmp/first_config.trx linux
```

tar:

```
cd /  # or /tmp if you want to review files before overwriting
gzip -dc /tmp/first_config.tgz | tar xvf - files_or_dirs[2]
```

[1] Or a different name of your choice at each significant build milestone.
[2] A space separated list of the files and/or directories you wish to restore or omit it to restore everything.

10 SETUP WIRELESS ENCRYPTION

Install the `nas` package which is needed to support WPA/WPA2 encryption

```
ipkg update          # Gets available package list
ipkg install nas     # Allows WPA/WPA2 encryption
```

Turn on encryption on your home router, reboot it for good measure then try to get encryption going on the ASUS.

This is not obvious with `wl0_mode=sta` Do not try to use the automatic protocol selections - choose one standard which your router supports. In my case the Netgear DG384GT supports WPA-PSK and TKIP but not WPA2 or AES. The nas module will not auto-negotiate in this mode so you must read your existing router's specs to establish which of these technologies it supports and choose compatible values for `wl0_akm` and `wl0_wpa_crypto`.

```
nvram set wl0_akm=psk              # or psk2/radius/radius2 (not multiple)
nvram set wl0_wpa_psk=<your WPA PreShared Key>
nvram set wl0_wpa_crypto=tkip      # Or aes (not both)
nvram commit
reboot
```

Hopefully you should be able to see the address of the ASUS in the list of attached devices in your home router and/or ping each router from the other. If not check, double-check and recheck all the nvram settings. Make sure the spellings of the variable names are correct as there is no error checking. You can create any old named values. It took me days to realise I had misspelled `wl0_wpa_crypto` as `wl0_wpa_crypt`.

11 OPEN UP ACCESS TO THE ASUS FROM WiFi

11.1 Firewall Change

This change is probably only necessary if you have a routed setup. Try the Firewall test first and only make the change if you don't get an SSH connection.

```
vi /etc/firewall.user
```

Remove the leading # from the two `iptables` command lines around 19 and 20 which refer to dropbear (a tiny ssh server) so that port 22 is available from the WiFi side.

Replicate these 2 lines for ports 21, 80 and 443 to allow FTP, HTTP and HTTPS access (one day). Hint: vi uses 2Y to yank (copy) 2 lines and P to put (paste) them.

```
reboot
```

11.2 Firewall test

Disconnect any wired connection between your LAN and the router and see if you can ssh onto the router via WiFi. i.e. Start PuTTY and connect to the host called 'asus' or 'asuswifi'

12 ADD IPKG SOURCE FEEDS

At this point, you are going to have to do some editing. My highly subjective opinion borne out of 20+ years of code-cutting under Unix is that vim is the best editor with vi as an acceptable alternative. There are loads of tutorials out there. Here is a link to just one:

http://www.eng.hawaii.edu/Tutor/vi.html

You may well think it is very terse and non-intuitive and if you can't get on with it, you may prefer to install nano which is easier to learn…

```
ipkg install \
http://downloads.openwrt.org/backports/0.9/nano_1.3.8-1_mipsel.ipk
```

I don't know how to use it but you can probably substitute `nano` everywhere you see `vi`.

There is a file called `/etc/ipkg.conf` which lists URLs for the various sources for software.

Note that ipkg seems to ignore the order of these entries when installing - I have a feeling that it is searching in alphabetical order of the URL! It probably looks first for the highest alphabetical filename to force it towards higher version numbers but my example had the same version of ntpclient in most of the feed locations and chose the nslu2 one which didn't auto-start. Therefore you should resist the temptation to put all known sources into `/etc/ipkg.conf` as you will never be sure a given package is coming from the closest matching source.

So far the only clean way I have found to pick up packages from exactly where you want is to create multiple copies of the ipkg.conf file. Each containing just the source you want to use.

If anyone finds a better way of doing this, please tell me!

```
cd /etc
vi ipkg.conf and add:
dest usbkey /usbkey      # in case you install a big package


cp ipkg.conf ipkg.0.9
vi ipkg.0.9 and add
```

/etc/ipkg.0.9(add these lines after existing src lines)

```
src backports http://downloads.openwrt.org/backports/0.9
src rc6 http://downloads.openwrt.org/backports/rc6
src rc5 http://downloads.openwrt.org/backports/rc5
src nslu2 http://ipkg.nslu2-linux.org/feeds/optware/wl500g/cross/stable
```

Save and exit then type:

```
ipkg -f /etc/ipkg.0.9 update    # Updates all package lists
```

Then copy that file 3 times to the following filenames:

```
cp ipkg.0.9 ipkg.rc6
cp ipkg.0.9 ipkg.rc5
cp ipkg.0.9 ipkg.nslu2
```

Then edit each of the 4 extra files (i.e all but ipkg.conf) file and delete the unwanted 'src' lines to leave the single corresponding src line and all the dest etc. lines.

ipkg.0.9:
```
src backports http://downloads.openwrt.org/backports/0.9
```

ipkg.rc6:
```
src rc6 http://downloads.openwrt.org/backports/rc6
```

ipkg.rc5:
```
src rc5 http://downloads.openwrt.org/backports/rc5
```

ipkg.nslu2:
```
src nslu2 http://ipkg.nslu2-linux.org…
```

13 SETUP TIME SYNC

The ASUS has no internal clock and keeps time using the cpu once set. This means it resets to 00:00 1 Jan 2000 at every reboot, and probably drifts thereafter. Clearly any sensible setup needs an accurate time so this is where the ntpclient module comes in.

```
ipkg install ntpclient          # Time sync
```

The ntp client package installs a startup script in `/etc/hotplug.d/iface`. This will set the clock on reboot. You also need to manually create a cron job for it to correct any clock drift while the ASUS is running. If you prefer you can leave this until later when we add the rt2mei crontab entry.

```
crontab -e
```

crontab contents to add:

```
23 * * * * /etc/hotplug.d/iface/10-ntpclient ifup
```

You also need to create the daylight saving rules

```
echo "GMT+0BST-1,M3.5.0/01:00:00,M10.5.0/02:00:00" > /etc/TZ
```

Note that this will not set the time until the router has finished booting so many system logs etc. will show year 2000 timestamps which only roughly indicate how long after booting any event happened.

14 SETUP USB SUPPORT

The following packages should give you USB 1.1 and 2.0 support for the Toppy.

```
ipkg install kmod-usb-uhci    # USB 1.0/1.1
ipkg install kmod-usb2        # USB 2.0
```

15 OPTIONAL USB DISK/KEY SUPPORT

This will support external disks/flash drives

```
ipkg install kmod-usb-storage # USB disks etc.
ipkg install kmod-vfat        # Windows FileSystems.
ipkg install kmod-ext2        # Earlier Linux FileSystems.
ipkg install kmod-ext3        # Later Linux FileSystems.
```

Install the fdisk partitioning utility from RC5 unless you find a native 0.9 version or a later backport!

```
ipkg -f /etc/ipkg.rc5 install fdisk
```

Power off, insert the USB media, power up and log back in.

```
dmesg | less
```

And look for something like this - in my case my USB key has 2 partitions.

```
hub.c: new USB device 01:03.2-2, assigned address 3
scsi0 : SCSI emulation for USB Mass Storage devices
  Vendor:           Model: Removable Disk    Rev: PMAP
  Type:   Direct-Access                      ANSI SCSI revision: 02
  Vendor:           Model: Removable Disk    Rev: PMAP
  Type:   Direct-Access                      ANSI SCSI revision: 02
Attached scsi removable disk sda at scsi0, channel 0, id 0, lun 0
Attached scsi removable disk sdb at scsi0, channel 0, id 0, lun 1
SCSI device sda: 3068928 512-byte hdwr sectors (1571 MB)
sda: Write Protect is off
Partition check:
 /dev/scsi/host0/bus0/target0/lun0: p1
SCSI device sdb: 3072 512-byte hdwr sectors (2 MB)
sdb: Write Protect is off
 /dev/scsi/host0/bus0/target0/lun1: p1
WARNING: USB Mass Storage data integrity not assured
```

The system seems to auto-mount the device under a generic name in /mnt, but preferring a more meaningful name, I remount it as /usbkey.

```
df    # Will show their sizes
```

Mount the partition(s) you are interested in e.g.:

```
mkdir /usbkey           # if it doesn't already exist
mount /dev/scsi/host0/bus0/target0/lun0/Part1 /usbkey
```

If the above works, create a file `/etc/init.d/S62mount` containing something like the following:

/etc/init.d/S62mount

```
umount /mnt/disc0_1
umount /mnt/disc1_1
mount /dev/scsi/host0/bus0/target0/lun0/part1 /usbkey
```

and then:

```
chmod 775 /etc/init.d/S62mount
```

I have not established how to cleanly prevent the automatic mount under /mnt but the ASUS doesn't seem to mind the same FS being mounted twice. The mount is performed by the `/etc/hotplug.d/usb/01-mount` script and it can probably be removed or chmodded to stop it executing. The two umount lines could then be removed from the above script.

16 BACKUP CONFIG TO EXTERNAL DRIVE

16.1 Backup

firmware image:

```
mkdir /usbkey/backup
mount -o remount,ro /dev/mtdblock/4 /jffs
dd if=/dev/mtdblock/1 > /usbkey/backup/bare_config[1].trx
mount -o remount,rw /dev/mtdblock/4 /jffs
dd if=/dev/mtdblock/3 > /usbkey/backup/bare_config.nvram
```

nvram, package list and /etc/config files as a compressed tar:

```
nvram show | sort >/etc/nvram.save  # Can take quite a few seconds
cd /
tar cvf - usr/lib/ipkg/status etc |
    gzip -c >/usbkey/backup/bare_config.tgz
```

16.2 Restore (untested)

firmware image:

```
dd if=/usbkey/backup/bare_config.nvram of=/dev/mtdblock/3
mount -o remount,ro /dev/mtdblock/4 /jffs
mtd -r write /usbkey/backup/bare_config.trx linux
```

tar:

```
cd /     # or /tmp if you want to review files before overwriting
gzip -dc /usbkey/backup/bare_config.tgz | tar xvf - files_or_dirs[2]
```

17 ADD TOPFIELD PACKAGES

17.1 puppy

```
ipkg -f /etc/ipkg.nslu2 install puppy
```

Puppy is the only binary installed in /opt/bin, and rt2mei looks for it there. Linking it seems cleaner than moving it or changing the PATH.

```
ln -s /opt/bin/puppy /bin
```

Test it:

```
puppy -c dir DataFiles  # Should show your recordings
```

[1] Or a different name of your choice at each significant build milestone.
[2] A space separated list of the files and/or directories you wish to restore or omit it to restore everything.

17.2 ftpd-topfield

Do not be tempted to use a version of ftpd-topfield from the nslu2 site because it doesn't work under OpenWRT - it displays directories as ?. If you see a newer OpenWRT version on Steveb's site it is worth trying though.

```
ipkg install libgcc

# Next 3 lines are entered as one continuous command line

ipkg install
http://members.ozemail.com.au/~msteveb/topfield/wl500g-
openwrt/ftpd-topfield_0.7.1-0_mipsel.ipk
```

Test it

```
/usr/bin/ftpd-topfield -D -P 21
```

Then try and access the ftp server on the ASUS from the wireless PC.

```
ftp asus
```

Log in as `anonymous` with no password (it doesn't accept any other user) then type `dir` which should show the top-level directories from the Toppy i.e. ProgramFiles DataFiles etc. If so, all's well. Type `bye` to exit. You could also try typing ftp://asus in the Windows Explorer address bar.

Back on the ASUS, add a startup script for ftpd-topfield. The nslu2 versions do this for you, but the OpenWRT port doesn't.

```
vi /etc/init.d/S65topfield
```

/etc/init.d/S65topfield:
/usr/bin/ftpd-topfield -D -P 21

Now make it executable

```
chmod 750 /etc/init.d/S65topfield
```

Then reboot the ASUS and test that ftpd-topfield has been started up automatically by trying remote ftp access again.

17.3 php (needed for rt2mei)

```
ipkg install libopenssl
ipkg install zlib
ipkg -f /etc/ipkg.0.9 install php5
ipkg -f /etc/ipkg.0.9 install php5-cli
ipkg -f /etc/ipkg.0.9 install php5-mod-pcre

vi /etc/php.ini
```

Add this line after the "Dynamic Extensions" commentary

/etc/php.ini
```
extension = pcre.so
```

17.4 rt2mei

This does not seem to be available as an ipkg package but it is just a few scripts so you can download the (nslu2) files to your PC from wooders' site unzip them and transfer them using pscp which is provided with PuTTY. You may want to edit rt2mei.cfg on your PC or use one that someone else in the same TV area is using.

On the ASUS:

```
mkdir /rt2mei
```

Back on the PC make sure your PATH is set up to find pscp, then in a command window, cd to the directory where you extracted the files and then transfer:

```
pscp -scp rt2mei r2tmei.* root@asus:/rt2mei
```

On the ASUS:

```
cd /rt2mei
chmod 775 rt2mei rt2mei.php
./rt2mei -ramdisk
```

You should see a load of progress messages about downloading channel data and then a transfer to the toppy.

Setup a cron job

```
crontab -e
```

crontab contents to add:

```
# Resync time at 23 minutes past every hour
23 * * * * /etc/hotplug.d/iface/10-ntpclient ifup
# Attempt to transfer EPG at 07:32 daily
32 07 * * * /rt2mei/rt2mei -ramdisk > /tmp/rt2mei.out
```

18 ADDING OTHER PACKAGES

You can add other packages using ipkg. It's worth checking how much memory you have free on the ASUS. The df (disk free) command will give something like this:

```
root@OpenWrt:~# df
Filesystem           1k-blocks      Used Available Use% Mounted on
/dev/root                 1024      1024         0 100% /rom
none                     15256      4696     10560  31% /tmp
/dev/mtdblock/4           6336      2484      3852  39% /jffs
/jffs                     1024      1024         0 100% /
```

Look in the *Mounted on* column:

- /jffs is the static ram and this will fillup as you add things to /
- /tmp is the dynamic ram and this will get affected by temporary files, runtime memory allocation etc. Its contents are lost at reboot.

If you have an external drive this will appear here too under whatever name(s) it is mounted

You can choose to add larger packages to the external drive by specifying another dest from the ipkg.conf file. E.g.

```
ipkg -f /etc/ipkg.0.9 -d usbkey some_package
```

You may then have to link parts of that filesystem into root and/or modify your PATH. See `ipkg-link` on the OpenWRT UsbStorageHowto

19 TOPPY SETUP

I use the PowerManager TAP to switch off my Toppy at night and set up a watch timer to wake it up before the above 07:32 download.

Depending on how you like it to work, and assuming you are using MyStuff, you could use the MergeMEI feature of eit2mei to populate the EPG for channels with no RT data. Peruse the forums for details but in essence you need to hand-edit the eit2mei.ini file to include a line like this:

```
MergeMEI=MyStuff.mei
```

And change MyStuff option L1=Never and L3=Freeview

20 USEFUL LINKS

Toppy UK site	http://www.toppy.org.uk
PuTTY	http://the.earth.li/~sgtatham/putty
OpenWRT site	http://openwrt.org
vi editor tutorial	http://www.eng.hawaii.edu/Tutor/vi.html
WhiteRussian	http://wiki.openwrt.org/OpenWrtDocs/Configuration
ASUS WL-500gP	http://wiki.openwrt.org/OpenWrtDocs/Hardware/Asus/WL500GP
Client mode	http://wiki.openwrt.org/ClientModeHowto
Switches/VLAN	http://wiki.openwrt.org/OpenWrtDocs/NetworkInterfaces
USB storage	http://wiki.openwrt.org/UsbStorageHowto
puppy	http://www.nslu2-linux.org/wiki/Puppy/HomePage
ftpd-topfield	http://members.ozemail.com.au/~msteveb/topfield/wl500g-openwrt/
rt2mei site	http://www.wooders.co.uk/rt2mei/
X-wrt web interface	http://x-wrt.org

21 LATER

A few things to try in the future:

- Install an SMB/Samba server and/or SMB/CIFS mount.
- Maybe install a command line ftp client (wput or curl) and make rt2mei use that so ftpd-topfield is the only file transfer agent.
- webif2 (especially HTTPS support when it arrives)
- Try out Toppyweb - probably needs to run on a separate host and needs editing to make use of the FTP service instead of assuming it can talk to the toppy directly.
- Generating MyStuff searches
- Creating an OpenWRT build environment under linux
- Generate a preconfigured firmware image with even more cutdown list of packages and Toppy utils preinstalled
- Redo for the Kamikaze release as and when it is considered stable

22 CREDITS

Thanks to all the people whose work I scoured for this information, especially the OpenWRT development team and the authors of all the Topfield specific packages.

Thanks also to R2-D2 for being the first guinea-pig for the guide, providing valuable feedback and for coming within gnat's whisker of bricking his router in the process.

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