ACPI: Advanced Configuration and Power Interface

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Revision History

Revision v1.5.1	2004–07–15	Revised by: ejh
Link included to the French translation of this document.		
Revision v1.5	2004–05–21	Revised by: ejh
Minor updates for the 2.6.6 kernel and corrections regarding which kernels need patching.		
Revision v1.4	2004–05–12	Revised by: ejh
Initial thoughts on the 2.6.5 kernel; includes information on battery monitoring applications causing touchpad lockup problems.		

Outlines how to patch a kernel for ACPI support.

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1. About this document

When I first started the switch from APM to ACPI I didn't realize the kernel needed to be patched. My problem (insanely loud fan) was fixed just by upgrading to 2.4.20 (Debian packaged kernel with an earlier patch from acpi.sourceforge.net). Unfortunately after the first upgrade I wasn't able to **halt** my computer without using the power switch to power−down my computer. It wasn't until later that I realized I had an old, ineffectual ACPI patch. This HOWTO was written to summarize the install process for myself, and hopefully help others who are also having a hard time finding information about ACPI. Please note: the main article outlines The Debian Way of doing things. There is also generic information in the Appendix B for those of you who prefer ... the generic way.

2. Copyright and License

3. Translations

This document is also available in the following languages:

- English version 1.2 translated to: Francais. Merci a Guillaume Lelarge et Vanessa Conchodon pour le traduction!

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4. About ACPI

In the world of power management ACPI is relatively new to the game. It was first released in 1996 by Compaq/Hewlett–Packard, Intel, Microsoft, Phoenix and Toshiba. These developers aimed to replace the previous industry standard for power management. Their ACPI.info site contains the official specifications, a list of companies that support ACPI and a number of other goodies. This is definitely not required reading, but may be of some interest to the insanely curious.

ACPI allows control of power management from within the operating system. The previous industry standard for power management, Advanced Power Management (APM), is controlled at the BIOS level. APM is activated when the system becomes idle––the longer the system idles, the less power it consumes (e.g. screen saver vs. sleep vs. suspend). In APM, the operating system has no knowledge of when the system will change power states.

ACPI can typically be configured from within the operating system. This is unlike APM where configuration often involves rebooting and entering the BIOS configuration screens to set parameters.

ACPI has several different software components:

- a subsystem which controls hardware states and functions that may have previously been in the BIOS configuration

  These states include:

  - thermal control
  - motherboard configuration
  - power states (sleep, suspend)
- a policy manager, which is software that sits on top of the operating system and allows user input on the system policies
- the ACPI also has device drivers that control/monitor devices such as a laptop battery, SMBus (communication/transmission path) and EC (embedded controller).

If you would like more information on power management in laptops, check out the resources on tuxmobil.org. Specifically: Power Management with Linux – APM, ACPI, PMU and the Hardware in Detail section of the Linux Mobile Guide.

5. Why switch?

Not all systems support both APM and ACPI. I switched because my system only supported ACPI. Pretty easy decision really. If you're switching to get S3 (suspend to RAM) support and you're using a 2.4.x kernel, don't bother. It is not supported. Period.

Not sure if your system is supported? ACPI4Linux has a list of supported machines/BIOSes started on their Wiki. Please contribute to the list if you've installed ACPI! They also have a list of machines that are not supported.

For more information about the power management in laptops you may (also) find the Battery Powered Linux Mini−HOWTO useful.

6. DSDT: Differentiated System Description Table

Thanks to Erich writing this section.

You might need to override the DSDT when certain features like battery status are incorrectly reported (usually causing error messages to syslog). DELL laptops usually need this kind of override. Fixed DSDT for many systems are available on the DSDT page, along with a patch that tells the kernel to ignore the BIOS−supplied table but use the compiled−in fixed DSDT.

Basically you need to copy the fixed table into your kernel source with a special filename (or modifying the filename in the patch supplied at the DSDT page) This override is quite easy: instead of loading the DSDT table from bios, the kernel uses the compiled−in DSDT table. That's all.

7. Installing from scratch

ACPI is constantly being revised. It is available in later versions of the 2.4.x series kernel (2.4.22 and higher), and all 2.6.x series kernels. If you would like to use a kernel before 2.4.22, you will need to patch your kernel source to add ACPI functionality. If at all possible you should use the latest stable version of the kernel. Patches are available from acpi.sourceforge.net.

Red Hat Fedora Core 2 now ships with ACPI enabled by default! This is big progress for the ACPI development team. Congratulations to everyone.

Even the latest kernel will sometimes have minor bug fixes available as a patch. You should check the ACPI4Linux web site to see if there are any patches available.

You need to get the patch that exactly matches the version of the kernel that you are running. Since this is the "install from scratch" section I will assume you know exactly which kernel you will be installing.

7.1. Choosing a kernel

This document was originally written for the 2.4.20 kernel and has been updated since to include information about the 2.6.x series kernels. At the time of this update the 2.6.x series kernels are proving easy for some and harder for others. (I personally cannot properly power down my computer with the 2.6.5 kernel.)

If you can, I would recommend waiting to upgrade your kernel to the 2.6.x series until more bugs are ironed out. There are a *lot* of changes in the 2.6.x series kernel. When I upgraded to 2.6.5 to update this document I ran into problems with my wireless connection, my nvidia graphics card, and with ACPI. Your mileage may vary. I personally had good success with the 2.4.20 with the latest patch and the 2.4.22 kernel with no patch. A Google through your distribution's mailing list, and the acpi−devel mailing list should help you to pick the right kernel.

This document uses the 2.4.20 kernel as an example for 2.4.x series kernels. Substitute your own kernel version as appropriate.

Regardless of which kernel you choose, if it is a kernel that requires patching, it is important to use the latest version of the ACPI patch. Some distributions have already patched their kernels. This is the case for Debian, and may be the case for others. For more information on the patches that have been applied to the Debian kernel source package scan through: `/usr/src/kernel−source−<version>/README.Debian`. If you are not using Debian you will probably still be able to find an equivalent file for your distribution.

A user on acpi−support confirmed that I shouldn't need any of the additional patches that have been applied to the kernel to run my laptop. If you are running a production−level server and/or are serving web pages to the internet, you should really apply any additional security patches.

If a kernel has had other patches applied to it, you may have problems applying the ACPI patch. Of course, an ACPI patch should not be applied to a kernel that is already patched for ACPI. As long as there has not been an ACPI patch applied to the kernel it should be possible to apply one now. Depending on the patches applied, you may need to modify some of the Makefiles for your patch to be successful. This is beyond my current grasp of reality so it is not covered in this document.

7.1.1. Debian−ized pre−patched kernel

If you would prefer to use a Debian−ized kernel instead of a fresh one, maxx has provided a pre−patched kernel−source package with the latest patch for the 2.4.20 kernel. This would be instead of downloading a fresh (non−patched) kernel from www.kernel.org. He sent me an email with the following details:

> I took the kernel−source 2.4.20−8 from unstable, removed the ACPI changes [i.e. the old patch] and applied `acpi-20021212-2.4.20.diff.gz` from acpi.sf.net since the vanilla 2.4.20 *HAS* several security leaks (ptrace, hash table, ...).
>
> You can find the package at http://people.debian.org/~maxx/kernel−source−2.4.20/ (I didn't upload the .orig.tar.gz since you can get it from any debian mirror and the .deb is already big enough)
>
> −−maxx

I have not tested these packages. You may or may not have any luck with them. Please don't email me asking about them, ask maxx instead.

8. Backups

If you are already running a kernel that is the same version of the one you are about to patch I recommend creating a fresh directory for the newly patched kernel. Remember that backups are *never* a bad thing. These are the files that I back up:

- `/etc/lilo.conf`
- `/usr/src/*.deb` (Debian−specific)
- `/etc/modules`
- `/etc/modutils/aliases`
- `/usr/src/linux/.config`
- If you are *not* doing things The Debian Way you should also back up the `/lib/modules` directory, `/boot/vmlinuz`, `/usr/src/linux/arch/i386/boot/bzImage` and `/usr/src/System.map`. It's possible my notes on the location of these files differs. Do a **`locate`** ***`<file>`*** if they're not where I've stated they should be.

9. Download and Unpack the New Kernel

9.1. Required packages

The following is a list of packages required to patch a 2.4.x series kernel. I am still working on the notes for a 2.6.x series install.

2.4.x series kernels

- kernel source files
- ACPI patch that exactly matches the kernel version
- debian packages: make, bzip2, gcc, libc6−dev, tk8.3, libncurses5−dev, kernel−package
- after you've patched the kernel add the debian packages: acpid, acpi (this last package is available in testing and unstable versions of Debian, but not stable)

9.2. Unpack

We need to unpack the bz2 file (bzip2) and shuffle the directories around a bit. `/usr/src/linux` probably points to your current kernel. We need it to point to the new kernel, so we'll do that as well.

- **cd `/usr/src`**
- **mkdir `kernel−source−`*`<version>`*** (use an alternate name if you already have a version of this kernel installed)
- **cp `linux.`*`<version>`*`.tar.bz2 /usr/src/kernel−source−`*`<version>`***
- **cd `/usr/src/kernel−source−`*`<version>`***
- **tar `xjfv linux.`*`<version>`*`.tar.bz2`**
- **mv `linux.`*`<version>`* `/usr/src/linux−`*`<version>`***
- **rm `linux`** (assuming that's a link to your old kernel)
- **ln `−s /usr/src/linux−`*`<version>`* `linux`**

If your kernel needs to be patched, do so now. Instructions are available from Appendix A.

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10. Configure the new kernel

Patch Your Kernel First

If you are using an old kernel you will need to patch it before you can proceed. Instructions on patching your kernel are available from Appendix A. The 2.6.x series kernels do not need to be patched.

Now instead of using **make *menuconfig***, I have an excellent alternative. Check this out: copy your current .config file into /usr/src/linux. Now use "**make *oldconfig***". It will run through your old config file and see what's been updated so that you don't have to find all the new options. For *everything* to do with ACPI and your specific hardware (Toshibas choose the Toshiba options, Asus choose the Asus options) choose M for module. There are about ten different ACPI related options that you will need to select.

In point form, this is how the kernel should be configured:

- **cd /usr/src/linux**
- **cp /usr/src/<*oldkernel-source-directory*>/.config .config**
- **make *oldconfig*** (say M to all new options for ACPI−−you can also say "Y" if you prefer to compile it directly into your kernel)

Now go in to the config file with **make *menuconfig***. I want you do check and make sure you have your APM (the old stuff) turned off. Under "General Setup", make sure that:

- Power Management Support is ON
- APM (Advanced Power Management) is OFF (this is the old one−−you don't even want it as a module unless you really know what you're doing. And if you really know what you're doing you're probably not reading this.)
- everything to do with ACPI should be M (modules) or * (compiled directly into the kernel). Read the list *carefully*. Some options will not apply to your hardware.

exit and save the new configuration

11. Compile the new kernel

If you have additional modules that are not part of the main source tree, you will need to add modules_image when you make your Debian packages. This is almost inevitable if you're using a laptop and an older kernel. Only my nvidia graphics card now requires additional modules.

- **cd `/usr/src/linux`**
- **make−kpkg *`clean`***
- **make−kpkg `--append-to-version=.<date>` *`kernel_image`* *`modules_image`***

Naming kernel builds

I no longer use `.date` to distinguish kernel builds. It was too frustrating to have 030627a, 032627b (etc) as I tried to figure things out. I now use names, in alphabetical order, starting with the kernel build "alien". I'm going to leave the date option in though as I still think it's a good way to do things.

My current kernel, 2.6.6, is "Elrond." The machine itself is "Smeagol."

Kernel compile help

For non−Debian instructions see the Appendix "Appendix B".

For more information on how to compile the kernel The Debian Way please read Creating custom kernels with Debian's kernel−package system

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12. Install the new kernel

I like to configure lilo on my own, but do whatever tickles your fancy.

- **cd `/usr/src`**
- **dpkg `-i` kernel−image−*<version>*.*<date>*_10.00.Custom_i386.deb** At this point I decline *all* the lilo updates and configure it myself by hand.
- configure lilo by hand: **vi `/etc/lilo.conf`**
- load the new kernel into lilo: **lilo**
- If you have any other deb files for your modules you should install them now as well. If you're not sure check `/usr/src` for additional `.deb` files.

Kernel compile help

For non−Debian instructions see the Appendix "Appendix B".

For more information on how to compile the kernel The Debian Way please read Creating custom kernels with Debian's kernel−package system

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13. Reboot and test

At this point you should reboot your machine. When your system comes back up (assuming of course that everything went well and you still have a system), check to see what kernel you're running with **uname −a**. It should show you the one you just built. You also need to make sure the correct patch was installed. You can do that with **dmesg | grep *ACPI.*Subsystem\ revision***. It should give the output: `ACPI: Subsystem revision 20021212`. The revision is the date the patch was released. This number will be different than mine if you are not using the 2.4.20 kernel. To look at all ACPI−related bits that were loaded/started when your system rebooted, do this: **dmesg | grep *ACPI***. **dmesg** prints your boot messages and **grep *ACPI*** makes sure that only ACPI−related messages are printed.

You can also check to see what version you're using with **cat /proc/acpi/info**. Don't believe everything you read though. My output says that S3 is a supported state, but we already know it's not. It does give the correct version though, which is useful.

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14. Load related modules

Check to see that each of the ACPI modules have been loaded after your machine boots. You can do this with the command **lsmod**. You are looking for the following options: button, battery, fan, ac, thermal and processor. If you chose "Y" instead of modules when you compiled your kernel, you will not see this list. The output on my computer looks like this:

```
Module                  Size  Used by    Tainted: P
button                  2420   0 (unused)
battery                 5960   0 (unused)
ac                      1832   0 (unused)
fan                     1608   0 (unused)
thermal                 6664   0 (unused)
processor               8664   0 [thermal]
NVdriver              945408  11
```

The last module is my graphics card, which uses proprietary drivers. This is why I have a "P" next to Tainted on the top line.

If you compiled ACPI support in as "M"odules and you don't see the ACPI modules listed you will need to load the modules by hand. The modules should be in `/lib/modules/<version>.<date>/kernel/drivers/acpi/`, and are as follows:

```
-rw-r--r--    1 root     root         4.1k Jun  3 23:57 ac.o
-rw-r--r--    1 root     root         9.5k Jun  3 23:57 battery.o
-rw-r--r--    1 root     root         5.2k Jun  3 23:57 button.o
-rw-r--r--    1 root     root         3.7k Jun  3 23:57 fan.o
-rw-r--r--    1 root     root          14k Jun  3 23:57 processor.o
-rw-r--r--    1 root     root          11k Jun  3 23:57 thermal.o
-rw-r--r--    1 root     root         6.2k Jun  3 23:57 toshiba_acpi.o
```

Extensions on Modules

The module name is the bit before `.o` extension on a module filename. `processor.o` is the file, and processor is the module name. To install a loadable kernel module use: **insmod *processor***.

The 2.4.x series kernels use the extension `.o`; however, the 2.6.x series kernel use the extension `.ko`.

The first time I rebooted I loaded them all by hand, typing **insmod *<modulename>***. I personally load processor first, although there are mixed feelings on whether or not the order matters.

Operating System Power Management (OSPM)

The first time I tried this the modules were all in separate directories and were ospm_<name>. This was probably because I was using an old patch, but it is something to be aware of. The OSPM modules are now deprecated so hopefully you won't see them.

To prevent having to load the modules each time you reboot you can do one of two things: compile them directly into the kernel (bit late for that though, eh?), or add them to your `/etc/modules` file. If you don't already have a copy of the file just create a new one and add each module name (remember, no dot–o) on a separate line. You can also try running **update–modules** which should automatically update your `/etc/modules.conf` configuration file.

15. Switching from APM to ACPI

Do not let apmd and acpid run at the same time unless you REALLY know what you're doing. Debian will *not* make sure only one is running at a time. You will have to check. APM will try to put your system into S3. On the 2.4.x (and before) series kernels this will quite probably hang your machine. S3 is not supported until at least 2.5.x. Even the patch won't provide support for S3 in the 2.4.x series kernels. I personally did an **apt−get remove apmd** to solve the hanging problem.

You should also be aware of another little glitch I discovered. The XFree86 server has an option for DPMS (Energy Star) features. The DPMS can states can be one of standby, suspend, off or on. Since the 2.4.x kernels cannot suspend to disk, this can cause problems. I fixed my system by doing two things:

- **xset `−dpms`** (disables DPMS features)
- In `/etc/X11/XF86Config−4` I commented out the line `Option "DPMS"` under Section "Monitor".

Lost Touchpad and Keyboard Interrupts

Karl Hegbloom emailed me to say that "keyboard keys sticking, touchpad pointer jumping suddenly across the screen, lockups under heavy network I/O [was] caused by polling the battery state via ACPI and the proc file system." This problem caused, in part, by a delay between the initial request for information about the battery's status and the response. In that delay interrupts may be locked out and synchronization with the keyboard and touch pad may be lost. "The overnight solution is to either turn off the battery applet, or reduce its polling frequency." Karl also notes that a BIOS update was also able to solve the problem. Thanks Karl!

I did not find this to be a problem for me in the 2.4.x kernels, however, it was a problem when I upgraded to 2.6.5. I use wmacpi to monitor my battery status. By setting the polling frequency to 1 (the lowest possible number), I seem to have eliminated the touchpad lockups. In my `.xinitrc` file I use:

`/usr/bin/wmacpi −s 1`

The *`−s 1`* represents the polling frequency (sample rate) of "once per minute." The default is 20.

16. Using ACPI

There are a few different applications/daemons you will want to install on your system: acpid (the daemon that will control your hardware states), and acpi (the interface to monitor events and states) are the base install. The acpi Debian package is only available in testing and is unstable. If you're running stable you won't be able to install it without playing around with apt and your `list.sources` file. You can probably also compile from source. If you do get acpi installed you can use it to monitor your system like this: **acpi `-V`**. The output will tell you about your system. Mine looks like this:

```
     Thermal 1: ok, 47.1 degrees C
     Thermal 2: ok, 45.1 degrees C
  AC Adapter 1: off-line <-- running off battery
  AC Adapter 1: on-line <-- running off AC power
```

Unfortunately, the `-V` "full version" doesn't work for me. Fortunately I can still look in each of the acpi files individually for information about my system. Check in the `/proc/acpi` directory for various things of importance. If I want to check my battery I read the following file like this: **cat `/proc/acpi/battery/BAT0/state`**. The output is as follows:

```
present:                 yes
capacity state:          ok
charging state:          discharging <-- running off battery
present rate:            unknown
remaining capacity:      3920 mAh <-- watch this number
present voltage:         14800 mV
```

```
present:                 yes
capacity state:          ok
charging state:          discharging
present rate:            unknown
remaining capacity:      3840 mAh <-- capacity getting smaller
present voltage:         14800 mV
```

```
present:                 yes
capacity state:          ok
charging state:          charging <-- AC adapter plugged in
present rate:            unknown
remaining capacity:      3840 mAh
present voltage:         14800 mV
```

If I want information about my battery in general I check it out like this: **cat `/proc/acpi/battery/BAT0/info`**

```
present:                 yes
design capacity:         3920 mAh
last full capacity:      3920 mAh
battery technology:      rechargeable
design voltage:          14800 mV
design capacity warning: 30 mAh
design capacity low:     20 mAh
capacity granularity 1:  10 mAh
capacity granularity 2:  3470 mAh
model number:            Bat0
serial number:
battery type:            Lion
```

```
OEM info:                    Acer
```

You're smart people. You can probably figure it out from here. :)

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17. References and Resources

The following URLs were incredibly useful in writing this HOWTO and generally getting ACPI up and running.

HOWTOs

HOWTO install ACPI under Linux
: http://sylvestre.ledru.info/howto/howto_acpi.php

Linux ACPI−HOWTO
: http://www.columbia.edu/~ariel/acpi/acpi_howto.txt

Linux on the road, formerly: Linux Laptop HOWTO
: http://tuxmobil.org/howtos.html You'll need to scroll a bit, or use the HTML version: http://tuxmobil.org/Mobile−Guide.db/Mobile−Guide.html

Hardware in Detail (part of Linux on the road)
: http://tuxmobil.org/Mobile−Guide.db/mobile−guide−p2c1−hardware−in−detail.html

Power Management with Linux − APM, ACPI, PMU
: http://tuxmobil.org/apm_linux.html

Battery Powered Linux Mini−HOWTO
: http://www.tldp.org/HOWTO/mini/Battery−Powered/

Creating custom kernels with Debian's Kernel−Package system
: http://newbiedoc.sourceforge.net/system/kernel−pkg.html

Hardware−specific Install Reports and Info

Installation Reports
: http://acpi.sourceforge.net/wiki/index.php/InstallationReports

Blacklist
: http://acpi.sourceforge.net/documentation/blacklist.html

DSDT: Overview
: http://acpi.sourceforge.net/dsdt/index.php Includes links to patched DSDTs and HOWTOs about patching your own DSDT.

BIOS Settings for the AcerTM (Phoenix BIOS)
: http://help.nec−computers.com/au/pri/item_instr_bios_7521N.asp

Software Development Groups

ACPI4Linux
: http://acpi.sf.net

ACPI Special Interest Group
: http://www.acpi.info/

Intel
: http://developer.intel.com/technology/iapc/acpi/

ACPI articles

Fan Speed Control Techniques in PCs
: http://www.analog.com/library/analogDialogue/archives/34−04/fan/

Mailing List Threads

debian−laptop thread: can't restore from suspend
: http://lists.debian.org/debian−laptop/2003/debian−laptop−200304/msg00367.html

acpi−support thread: newbie HOWTO and debian patching
: http://sourceforge.net/mailarchive/forum.php?forum_id=7803&max_rows=25&style=flat&viewmonth=200304&viewday=17

debian−laptop thread: acer 634 acpi & apm
: http://lists.debian.org/debian−laptop/2002/debian−laptop−200212/msg00242.html

ACPI packages and related software

The Kernel
: Remember to choose "F" for full when you download your kernel source. http://www.kernel.org

Debian−ized kernel
: maxx's pre−patched 2.4.20−8 kernel source package. For more information see maxx's notes. http://people.debian.org/~maxx/kernel−source−2.4.20/

ACPI kernel patch
: You'll need to pick the version that exactly matches the kernel you're using. http://sourceforge.net/project/showfiles.php?group_id=36832

acpid
: the daemon http://sourceforge.net/projects/acpid

acpi
: text interface http://grahame.angrygoats.net/acpi.shtml

Kacpi
: graphical interface for KDE http://www.elektronikschule.de/~genannt/kacpi/download.html

aKpi
: another KDE interface http://akpi.scmd.at/

wmacpi
: WindowMaker DockApp (another GUI) http://www.ne.jp/asahi/linux/timecop/

wmacpi+clecourt
: WindowMaker DockApp (another graphical interface). Handles two battery slots. http://open.iliad.fr/~clecourt/wmacpi/index.html

18. Thanks

Much thanks goes out to the following:

- acpi−support (note: the discussion list for ACPI4Linux is now at acpi−devel)
- debian−laptop
- debian−user
- techtalk
- TLDP mailing lists (discuss and docbook)
- Sebastian Henschel for reminding me I'd promised to write it all down
- Erich Schubert for writing the section on DSDTs
- Werner Heuser for suggesting I submit the document to The LDP
- Tabatha Marshall for editing and generally being very enthusiastic about learning DocBook

A. Patching Old Kernels

If you are using a 2.4.x series kernel, the kernel will need to be patched before you can add ACPI support. Although ACPI is included in the 2.6.x series kernels you should check to see if any patches have been released to fix bugs. You can find this information on the ACPI4Linux site.

A.1. Getting the Source Files

Download a fresh kernel from www.kernel.org. You need to make sure you get a full kernel. Find the "latest stable version of the Linux kernel" and click on F for FULL. Wait patiently. A bzipped kernel is about 26M. If you're feeling particularly geeky you could also **wget** http://kernel.org/pub/linux/kernel/v2.4/linux-<*version*>.tar.bz2.

You may or may not want the latest stable version. For more information read the Section 7.1 section of this document. If you decide to use a version of the kernel that is not published on the front page, use the /pub/linux/kernel directory on the kernel.org site to find the kernel you'd like.

While you're waiting, grab a copy of the patch as well. For the 2.4.20 kernel use the 2.4.20 patch. It's dated 2002.12.12. You'll need to know that number later when we check to make sure the patch worked. If you are using a different kernel version make sure you take note of the date of your patch. Your numbers will differ slightly from the one I use later on.

Once you've got those two files (the kernel and the patch) unpack them and patch the kernel.

A.1.1. Patch

Now we're going to actually patch the kernel. I take one extra step from the instructions at ACPI4Linux. Instead of gunzipping and patching in the same line, I use two lines. This is purely a matter of preference. When you patch the kernel you want to make sure there are no error messages. (There is no "yay" line, instead look for the absence of errors.)

- **cd /usr/src/linux**
- **cp acpi-20021212-2.4.20.diff.gz /usr/src/linux/.** (Your patch filename will be different if you're not using the 2.4.20 kernel.)
- **gunzip acpi-20021212-2.4.20.diff.gz**
- **patch -p*1* < acpi-20021212-2.4.20.diff** (this is the actual patching part)

Once you've finished patching your kernel, continue reading at Section 10.

B. ACPI the Non−Debian Way

There is very little difference between The Debian Way and the generic way. In fact it's probably only 10 or so lines of difference.

B.1. Compile the kernel

The "normal" way of compiling a kernel does not use **make−kpkg**. Instead, it uses the following steps:

- **cd** **`/usr/src/linux`** which should point to the 2.4.20 kernel (unzipped) files
- **make** ***`dep`***
- **make** ***`clean`***
- **make** ***`bzImage`***
- **make** ***`modules`*** (remember to unpack your modules first)

B.2. Install the new kernel

In *The Debian Way*, you create a deb file which contains information about where the kernel is (and makes the kernel and yada–yada). In the "normal" way, you put things where they need to be right away. You need to install your modules and then configure lilo to point to the new kernel and then run lilo. If you are not doing things *The Debian Way* your "install" will look like this:

- **cd /usr/src/linux**
- **make *modules_install***
- **cp arch/i386/boot/bzImage /boot/vmlinuz.<*date*>**
- **vi /etc/lilo.conf** and copy the structure of your existing kernel. Do NOT delete the reference to your existing kernel! You need to point lilo to the "vmlinuz" file that was created when you compiled the kernel above
- **lilo** (yup, just exactly like that.) Lilo will let you know if it's going to have major problems loading the new kernel.

Do NOT forget to run lilo before rebooting. Type **lilo**. It's that easy (and that easy to forget).

B.3. Software packages

You can still use all of the software mentioned in this HOWTO even if you're not using Debian. Unfortunately it will take a little more effort on your part to download and install everything. Fortunately it's really not that difficult. Most software packages include a README file when you gunzip them which will explain what you need to do to get things working on your system.

Software downloads

For more information about software for ACPI, please use the ACPI packages and related software.

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