
ACPI: Advanced Configuration and Power Interface

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Minor updates for the 2.6.6 kernel and corrections regarding which kernels need patching.		
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Initial thoughts on the 2.6.5 kernel; includes information on battery monitoring applications causing touch pad lockup problems.		

Abstract

Outlines how to patch a kernel for ACPI support.

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About this document

Copyright and License

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Translations

This document is also available in the following languages:

- Français [<http://www.traduc.org/docs/HOWTO/lecture/ACPI-HOWTO.html>]. Merci à Guillaume Lelarge et Vanessa Conchodon pour le traduction !

If you know of any other translations, please email me <emmajane@xtrinsic.com>.

Preface

When I first started the switch from APM to ACPI I did not realize the kernel needed to be patched. My problem (very loud fan) was fixed just by upgrading to 2.4.20 (Debian packaged kernel with an earlier patch from acpi.sourceforge.net [<http://acpi.sourceforge.net>]). Unfortunately after the first upgrade I was not able to correctly power down my computer. It was not 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 [<http://www.debian.org>] of doing things. There is also generic information in the Appendix B, *Compiling Kernels the Non-Debian Way* for those of you who prefer ... the generic way.

Acknowledgments

I have found that it takes a whole community to write a technical guide. I am forever grateful for all of the support that I have received along the way. Without this (ever growing) group of people our document would not exist.

- `acpi-devel` [<http://acpi.sourceforge.net/maillinglists.html>]
- `debian-laptop` [<http://lists.debian.org/debian-laptop/>] and `debian-user` [<http://lists.debian.org/debian-user/>]
- `techtalk` [<http://linuxchix.org/>]
- TLDP mailing lists [<http://www.tldp.org/mailinfo.html#maillists>] (discuss and docbook)
- Sebastian Henschel for reminding me I had promised to write it all down
- Erich Schubert for writing the section on DSDTs when I could not
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- Werner (again) and Nicolas “nico” Boulay for helping me to update my BIOS at the 2004 Libre Software Meeting [<http://www.libresoftwaremeeting.org>]
- Michal “mizu” Zimen for discovering the solution to the `acpi_power_off` problem
- Traduc [<http://www.traduc.org>] for working on the French translation.

Feedback

Find something wrong with this document? (Or perhaps something right?) I would love to hear from you. Please email me at [<emmajane@xtrinsic.com>](mailto:emmajane@xtrinsic.com).

Conventions used in this document

The following typographic and usage conventions occur in this text:

Table 1. Typographic and usage conventions

Text type	Meaning
“Quoted text”	Quotes from people, quoted computer output.
<code>terminal view</code>	Literal computer input and output captured from the terminal.
command	Name of a command that can be entered on the command line.

Text type	Meaning
<code>option</code>	Option to a command, as in “the <code>-a</code> option to the <code>ls</code> command”.
<code>parameter</code>	Parameter to a command, as in “read man <i>ls</i> ”.
<code>command options arguments</code>	Command synopsis or general usage, on a separated line.
<code>filename</code>	Name of a file or directory, for example “Change to the <code>/usr/bin</code> directory.”
Menu → Choice	Choice to select from a graphical menu, for instance: “Select Help → About Mozilla in your browser.”
The author [http://www.xtrinsic.com]	Click-able link to an external web resource.

Thanks to Machtelt “Tille” Garrels for this list of conventions.

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](http://www.acpi.info) [<http://www.acpi.info>] site includes the official specifications, and a list of companies that support ACPI. This is not required reading, but may be of some interest to the 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 (for example: screen saver, sleep and 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
- device drivers that control/monitor devices such as a laptop battery, SMBus (communication/transmission path) and EC (embedded controller).

More information on power management in laptops is available from [tuxmobil.org](http://www.tuxmobil.org) [<http://www.tuxmobil.org>]. Specifically: Power Management with Linux - APM, ACPI, PMU [<http://www.tuxmobil.org>].

tuxmobil.org/apm_linux.html] and the Hardware in Detail [<http://tuxmobil.org/Mobile-Guide.db/mobile-guide-p2c1-hardware-in-detail.html>] section of the Linux on the Road [<http://tuxmobil.org/Mobile-Guide.db/Mobile-Guide.html>].

Why switch?

Not all systems support both APM and ACPI. I switched because my system only supported ACPI. Pretty easy decision really. If you are switching to get S3 [<http://acpi.sourceforge.net/documentation/sleep.html>] (suspend to RAM) support and you are using a 2.4.x kernel, do not bother. It is not supported [<http://lists.debian.org/debian-laptop/2003/debian-laptop-200304/msg00418.html>].

ACPI4Linux [<http://acpi.sf.net>] has a list of supported machines/BIOSes [<http://acpi.sourceforge.net/wiki/index.php/InstallationReports>] and a list of unsupported machines [<http://acpi.sourceforge.net/documentation/blacklist.html>]. Please contribute to the list!

For more information about the power management in laptops you may (also) find the Battery Powered Linux Mini-HOWTO [<http://www.tldp.org/HOWTO/mini/Battery-Powered/index.html>] useful.

Distribution News

As ACPI support matures in Linux there may be some specific things you should know with regards to your distribution. At this time there is very little news to share, but I hope this section will grow with time. Please email me at <emmajane@xtrinsic.com> if there is anything else that should be reported in this section!

News for your distro

Fedora Core 2 Red Hat Fedora Core 2 now ships with ACPI enabled by default! This is big progress for the ACPI development team. Congratulations to everyone. Fedora Core 2 users please skip right past the installation instructions and go directly to Using ACPI.

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. You should always use the latest stable version of the kernel that your system will support. Patches are available from acpi.sourceforge.net [<http://acpi.sourceforge.net>]. If you must use a kernel older than version 2.4.22 you will need to patch your kernel to get ACPI support.

Always check for kernel patches

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.

DSDT: Differentiated System Description Table

Thanks to Erich [<http://www.vitavonni.de/>] 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 [<http://acpi.sourceforge.net/dsdt/index.php>], 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 [<http://acpi.sourceforge.net/dsdt/index.php>]) This override is quite easy: instead of loading the DSDT table from BIOS, the kernel uses the compiled-in DSDT table. That is all.

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.

If you can, I would recommend waiting to upgrade your kernel to the 2.6.x series until more bugs are ironed out, and more documentation is available. 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, my touch pad, 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. (And then I upgraded from 2.4.22 directly to 2.6.5.) A Google through your distribution's mailing list, and the acpi-devel mailing list should help you to pick the right kernel.

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 look in the `/usr/src/kernel-source-<version>` directory for an equivalent file.

Using pre-compiled kernels

I do not use the Debian pre-compiled kernels. I always opt to compile my own kernels using The Debian Way. If you are using your distribution's pre-compiled kernel, please check to make sure it has all relevant ACPI patches applied before you install it.

If you are running a production-level server and/or are serving web pages to the Internet, please also apply any additional security patches. You may have additional patches which must be applied for hardware or software problems specific to your system. Most laptop users should be fine with only the ACPI patch. If possible laptop users should also apply any additional security patches.

Patching a previously patched kernel

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. 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.

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. You should create a backup of all important kernel configuration and kernel-related files that may be affected by your work. Remember that backups are *never* a bad thing and can be easily deleted after your system has been successfully patched.

Example 1. Files to backup

- /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 following files:

- /lib/modules (the entire directory)
- /boot/vmlinuz
- /usr/src/linux/arch/i386/boot/bzImage
- /usr/src/System.map

It is possible the location of these files differs on your system. Use locate as follows if the files are not in the locations specified above:

```
locate <file>
```

Download and unpack the kernel source

Required packages

The following is a list of packages required to patch a kernel.

Example 2. Packages required for patching your kernel

2.6.x series kernels

- kernel source files
- ACPI patch that exactly matches the kernel version
- debian packages: binutils, e2fsprogs, gcc, make, module-init-tools, procs, util-linux (see also the list from 2.4)

Learn more about the 2.6 kernel before you upgrade

This HOWTO does not include information on how to migrate from a 2.4 series kernel to a 2.6 series kernel. Please read the resources listed in Migrating to the 2.6 series kernels before attempting a kernel upgrade.

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

Getting the Source Files

Download a fresh kernel from www.kernel.org [<http://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 bziped kernel is about 26M. If you are feeling particularly geeky you could also grab the file from the command line with `wget`.

Tip

You may or may not want the latest stable version. For more information read the the section called “Choosing a kernel” 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` [<http://www.kernel.org/pub/linux/kernel/>] directory on the `kernel.org` [<http://www.kernel.org>] site to find the kernel you would like.

Example 3. Download the kernel and patch

1. `wget http://kernel.org/pub/linux/kernel/v2.4/linux-<version>.tar.bz2`
2. Download the latest patch for your kernel. This may or may not be the newest patch available. Please look carefully. For example: if you are using the 2.4.20 kernel you would get `acpi-20021212-2.4.20.diff.gz`. The patches can be downloaded from: <http://prdownloads.sourceforge.net/acpi>.
3. Note the revision date. In this example above the date is 20021212 (December 12, 2002), but it will almost certainly be different for your kernel. You will need to know this number when you check to make sure the patch worked.

Unpack

You will need to unpack the bz2 file (bzip2) and move the directories into place. `/usr/src/linux` probably points to your current kernel. This link must point to the new kernel, you will update that link now as well.

Example 4. Unpacking your kernel source files

1. `cd /usr/src`
2. `tar xjfv linux.<version>.tar.bz2`
3. `rm linux` (assuming it is a link to your old kernel)
4. `ln -s /usr/src/linux.<version> linux`

If your kernel needs to be patched, do so now. Full instructions are available from Appendix A, *Patching Kernels* or you can skip right to the step-by-step instructions at *Patching your kernel*.

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, *Patching Kernels*. Always check to see if your kernel should be patched.

Use **make oldconfig** to configure your new kernel. Using *oldconfig* instead of *menuconfig* allows you to start with the options you have selected in your current kernel and prompts you to select your preference for all new kernel options. This is much easier than looking for all of the new options by hand. For everything specific to ACPI and your hardware (if you use a Toshiba 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.

Example 5. Configuring your kernel

Please also read the list of Known Issues.

1. **cd /usr/src/linux**
2. **cp /usr/src/<oldkernel-source-directory>/ .config .config**
3. **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)
4. Please confirm the kernel is properly configured:
 1. **make menuconfig**
 2. Select “General Setup”
 3. Confirm Power Management Support is ON
 4. Confirm APM (Advanced Power Management) is OFF (this is the old style of power management that is being replaced)
 5. Check everything to do with ACPI. Options related to your hardware should be M (modules) or * (compiled directly into the kernel). Read the list *carefully*. Some options will not apply to your hardware.
6. Exit and save the new configuration

Compile and install the new kernel

It is now time to compile the kernel. These instructions are for Debian users. If you are not using Debian, or you do not like compiling your kernel The Debian Way, please read Appendix B, *Compiling Kernels the Non-Debian Way* for more help.

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 are using a laptop and an older kernel. I still need this option even in the 2.6.6 kernel due to my nVidia graphics card.

Example 6. Compiling the kernel The Debian Way

Each of these steps should be performed as the root user.

1. **cd /usr/src/linux**
2. **make-kpkg clean**
3. **make-kpkg** **--append-to-**
version=.<a_unique_and_clever_name> **kernel_image**
modules_image

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”. My current kernel build is “Ulairi.” (The machine itself is “Smeagol”--a name it has earned.)

Now that the kernel is compiled it can be “installed.” For Debian users this means installing the Debian package file you created in the last step and then loading the new kernel into lilo. I like to configure lilo on my own and have provided the instructions here, but I leave that decision up to you.

Example 7. Install the new kernel

Each of these steps should be performed as the root user.

1. **cd /usr/src**
2. **dpkg -i kernel-image-<version>.<a_unique_and_clever_name>_10.00.Custom_i386.deb**
3. At this point I decline *all* the lilo updates and configure it myself by hand.
4. To configure lilo:
 1. **vi /etc/lilo.conf**
 2. Scroll to the end of the file and look for a line that starts with `image=`.
 3. Create an entry for your new kernel by adding the following three lines:

```
image=/vmlinuz
label=<a_unique_and_clever_name>
read-only
```
 4. Update the entry for your old kernel so that it points to the right `vmlinuz` file. You can use either `vmlinuz.old` if this is your first time recompiling the kernel, or look in `/boot` for the correct file.
 5. If you would like, you can update the kernel that is selected by default by changing the `default=` parameter.
5. load the new kernel into lilo by running `lilo` from the command line. You need only type: **lilo**
6. If you have any other deb files for your modules you should install them now as well. If you are not sure check `/usr/src` for additional `.deb` files.

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), you will need to check that you are running the new kernel with the correct patch.

Example 8. Confirm installed kernel and ACPI patch version

First you need to make sure you are running the correct kernel. This can be done with the command line tool `uname`. The revision is the date the patch was released and will be different for each kernel release.

```
$ uname -a
```

Assuming you are indeed running the new kernel, you can now check the ACPI's revision date with the following command.

```
$ cat /proc/acpi/info
```

This may give you only a version number, or a more detailed list. You are looking for the line that starts with *version:*.

If for some reason that gives you no information, you can also check the message printed when ACPI was first loaded as the system was booting. This information can be printed to a terminal window with the application *dmesg*.

```
$ dmesg | grep ACPI.*Subsystem\ revision
```

It should give the output: *ACPI: Subsystem revision 20040326*. The revision number is the date the patch was originally released by the development team. If you patched your kernel according to Appendix A, *Patching Kernels* this number will match the patch that you installed in *Patching your kernel*.

To read all the ACPI-related information, you can expand the pattern that *grep* matches and selectively print all ACPI messages:

```
$ dmesg | grep ACPI
```

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
<i>button</i>	2420	0 (unused)	
<i>battery</i>	5960	0 (unused)	
<i>ac</i>	1832	0 (unused)	
<i>fan</i>	1608	0 (unused)	
<i>thermal</i>	6664	0 (unused)	
<i>processor</i>	8664	0 [<i>thermal</i>]	
<i>NVdriver</i>	945408	11	P

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 do not see the ACPI modules listed you will need to load the modules by hand. The modules should be in */lib/modules/<version>.<a_unique_and_clever_name>/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 will not 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 do not already have a copy of the file just create a new one and add each module name (remember, no dot) on a separate line. You can also try running **`update-modules`** which should automatically update your `/etc/modules.conf` configuration file.

Using ACPI

There are a few different applications/daemons you should install on your system: `acpid` (the daemon that will control your hardware states), and a monitoring program. I personally use `wmacpi`. There are lots to choose from in ACPI packages and related software.

Switching from APM to ACPI

Do not let `apmd` and `acpid` run at the same time unless you REALLY know what you are 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 probably cause your machine to lock up. S3 is not supported until at least 2.5.x. Even the patch will not provide support for S3 in the 2.4.x series kernels. I completely removed APM support from the kernel, and removed the `apmd` daemon from my system. On Debian this was as easy as **`apt-get remove apmd`**.

/proc/acpi files

You can also look in each of the ACPI files individually for information about your system. Look 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
```

For more information on each of these files, please read <http://acpi.sourceforge.net/documentation/index.html>.

A. Patching 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.

Patch

Now you are going to actually patch the kernel. I take one extra step from the instructions [<http://acpi.sourceforge.net/download.html>] 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.)

Example A.1. Patching your kernel

These steps should be performed as the root user.

1. `cd /usr/src/linux`
2. `cp acpi-20021212-2.4.20.diff.gz /usr/src/linux/`. (Your patch filename will be different if you are not using the 2.4.20 kernel.)
3. `gunzip acpi-20021212-2.4.20.diff.gz`
4. `patch -p1 < acpi-20021212-2.4.20.diff` (this is the actual patching part)

Once you have finished patching your kernel, continue reading at the section called “Configure the new kernel”.

B. Compiling Kernels the Non-Debian Way

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

Compile the kernel

The “normal” way of compiling a kernel does not use `make-kpkg`. Instead, it uses the following steps:

Example B.1. Compile the kernel

1. `cd /usr/src/linux` which should point to the kernel (unzipped) files
2. `make dep`
3. `make clean`
4. `make bzImage`
5. `make modules` (remember to unpack your modules first)

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:

Example B.2. Install the new kernel

1. `cd /usr/src/linux`
2. `make modules_install`
3. `cp arch/i386/boot/bzImage /boot/
vmlinuz.<a_unique_and_clever_name>`

4. `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
5. `lilo` (yup, just exactly like that.) LILO will let you know if it is going to have major problems loading the new kernel.

Warning

Do NOT forget to run lilo before rebooting. Type `lilo`. It is that easy (and that easy to forget).

Software packages

You can still use all of the software mentioned in this HOWTO even if you are not using Debian. Unfortunately it will take a little more effort on your part to download and install everything. Fortunately it is 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.

C. Known Issues

There are a number of problems which have been identified for various laptop models. Please scan through this list before you finish compiling the kernel to see if your hardware is affected by any of the following problems. You may also want to use this as a trouble shooting guide after installing your system if you are still having problems.

Known issues for the 2.4 kernel include:

- DPMS (Energy Star) features try to suspend the laptop

Known issues for the 2.6 kernel include:

- `acpi_power_off` hangs
- touch pad/mouse or keyboard freezes

2.4 series kernels

DPMS features

This is not a bug exactly, but it is something to be aware of. The XFree86 server has an option for DPMS (Energy Star) features. The DPMS 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:

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

2.6 series kernels

acpi_power_off hangs in 2.6

There are a couple of solutions to this problem, depending on your laptop.

The easiest option to try is to remove the APIC options at boot time. This has been reported to work on a Sony TR2. In the `/etc/lilo.conf` file look for a line that has `append=""`. Inside the quotes add the words `nolapic` and `noapic`.

Example C.1. Updating the append directive in LILO

Open and edit the `/etc/lilo.conf` configuration file as root. Add the appropriate instructions to the existing `append` statement. If there is not an `append` statement you can add one right before the list of boot disk images. In my `/etc/lilo.conf` it would look like this:

```
append="nolapic noapic"

default="<a_unique_and_clever_name>"
image=/vmlinuz
label=<a_unique_and_clever_name>
read-only
```

After editing the configuration file, load the new information by running the command `lilo` as root.

```
# lilo
```

You can also remove these two modules from the kernel completely by removing the following kernel options: `CONFIG_X86_UP_APIC`, `CONFIG_X86_UP_IOAPIC`. This is what I have done with my Acer TravelMate.

Acer TravelMates should also disable the RTC-related modules. They are not needed for “normal” operation.

The following kernel modules should be unselected to allow the notebook to power off correctly:

- `CONFIG_HPET_EMULATE_RTC`
- `CONFIG_RTC`
- `CONFIG_SND_RTCTIMER`

Thank you to mizu for discovering this solution!

Touchpad/Mouse or Keyboard Freezes

Karl Hegbloom emailed me to say that “keyboard keys sticking, touch pad 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 is caused by a delay between the initial request for information about the battery’s status and the response. In that delay communication with the keyboard or touch pad may

be temporarily interrupted causing the device to become out of sync (jumpy) or the communication lost (freeze). “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 touch pad 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.

Caution

If you recently upgraded to the 2.6 series kernel, make sure your touch pad drivers are correctly installed as well. You may find the following KernelTrap article useful if you are not sure where to start: <http://kerneltrap.org/node/view/2199>.

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Glossary

Terms and definitions for the many TLAs in this document. Some entries are modified from the Linux Dictionary [<http://www.tldp.org/LDP/Linux-Dictionary/>].

A

ACPI	Abbreviation for Advanced Control and Power Interface. Allows control of power management from within the operating system. See also: APM
APIC	Abbreviation for Advanced Programmable Interrupt Controller. A set of devices that make up an interrupt controller for multi-processor support. It consists of three parts: local APIC, In/Out APIC and an APIC bus.
APM	Abbreviation for Advanced Power Management. Power management from within the BIOS. Replaced by ACPI. See also: ACPI See also: BIOS

B

BIOS	Abbreviation for Basic Input/Output System. Services that allow the hardware and software of a computer to communicate.
------	---

D

Debian	The distribution of Linux used by the author. http://www.debian.org
DPMS	Abbreviation for Display Power Management Signaling. A standard developed to extend the life of PC monitors and conserve energy when monitors are not in use.

DSDT Abbreviation for Differentiated System Description Table. This table contains information and configuration about the base system. It is not always capable of supplying fully function tables and sometimes must be patched.

See also: patch, <http://acpi.sourceforge.net/dsdt/index.php>.

L

LILO Abbreviation for LInux LOader. Installs the boot loader which decides the operating system to use when the computer is first turned on. You may have Grub installed instead.

K

kernel The core of an operating system. Responsible for many things including managing resources, sharing memory and user access.

See also: <http://www.kernel.org>

M

module A piece of code that can be loaded or unloaded from the main program. In this document module refers to kernel modules.

See also: kernel

P

patch A fix applied to the source code of a program. Used to correct bugs or enhance a program's capabilities.

R

RTC Abbreviation for Real Time Clock. Used by the system to keep track of time while the computer is powered off.

See also: <http://www.linuxgazette.com/node/view/8993>

T

TLA Abbreviation for Three Letter Acronym. Developers love to use their TLAs. Most of the time they do not even notice.

References and Resources

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. <http://tuxmobil.org/Mobile-Guide.db/Mobile-Guide.html>.

Hardware in Detail. <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>.

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. <http://www.kernel.org>.

ACPI kernel patch. http://sourceforge.net/project/showfiles.php?group_id=36832.

ACPI daemon acpid. <http://sourceforge.net/projects/acpid>.

acpi. <http://grahame.angrygoats.net/acpi.shtml>.

Kacpi. <http://www.elektronikschule.de/~genannt/kacpi/download.html>.

aKpi. <http://akpi.scmd.at/>.

wmacpi. <http://www.ne.jp/asahi/linux/timecop/>.

wmacpi+clecourt. <http://open.iliad.fr/~clecourt/wmacpi/index.html>.

Migrating to the 2.6 series kernels

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Kernel Build HOWTO. <http://www.digitalhermit.com/linux/Kernel-Build-HOWTO.html>.

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