The Webcam HOWTO

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This document was written to assist the reader in the steps necessary to configure and use a webcam within the Linux operating system.
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A. Gnu Free Documentation License ........................................................................................................................................17
1. Introduction

This document was written to assist the reader in setting up and configuring a webcam, digital camera, or other video device in the Linux operating system. It outlines how to enable the necessary kernel and/or software support and various frame-grabber applications that can be used to access your device. It does not discuss the differences in graphic and video formats, the features and/or capabilities of particular devices, or the encoding or conversion of video formats.

1.1. Copyright Information

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1.2. Disclaimer

No liability for the contents of this document can be accepted. Use the concepts, examples and other content entirely at your own risk. As this is a new edition, there may be technical or other inaccuracies that may result in the loss of irreplaceable data. In any case, proceed with caution, and realize that although errors are highly unlikely, the author can accept no responsibility for them.

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1.3. New Versions

This is the initial release.

The latest version number of this document can be found here.

1.4. Credits

I would like to thank all of the individuals that have pioneered video support for linux, in particular the v4l and v4l2 teams, Gerd Knorr, and the Metzler Brothers among others.

Also, I would like to thank Marla, who has the grace to accept my imperfections and idiosyncrasies unconditionally, including my obsession with projects such as this.
1.5. Feedback

Please send any additions or comments pertaining to this document to the following email address: <hshane[@]austin.rr.com>. In particular, if you have information about new devices or interfaces supported or errata, please contact me so we can keep this document up-to-date!

1.6. Conventions Used in this Document

The following conventions are used in this document and are outlined here for those who may not yet have a complete understanding of how to access and control the underlying operating system in Linux, which is almost always via the Bash shell.

First, filenames are referenced in a paragraph like so: /path/file

Commands in Linux are executed (or 'called') at the command prompt, otherwise known as the 'command line'. If you are in the non-graphical (text-based) environment, you will usually be presented with the Bash shell prompt which is a dollar sign:

```
$
```

...or the hash mark:

```
#
```

...if you have logged in as root, have acquired root, or 'superuser' privileges. You can also access the Bash shell in the X window system, otherwise known as X or X11, with an xterm or similar X-terminal-emulator. Commands to be performed at the Bash prompt, but referenced in a paragraph of this document, usually look like this: do this now

Commands and/or the resulting output of commands may also be outlined with screen output in their own paragraph or heading:

```
$ date
Sun Jul 27 22:37:11 CDT 2003
```

When a command is written in front of the Bash prompt (e.g., $ date above), it is assumed the [Return] or [Enter] key has been pressed after the command, possibly followed by the output on a new line (e.g., as in the date in the above example).
2. Supporting the Connection Type

2.1. USB Webcams

If you have a USB webcam, it is very possible your hardware has at least some support in Linux. There are two ways of supporting USB devices in Linux. One is the more traditional kernel support, and the other is through libusb. If you would prefer the more conventional kernel support for USB devices, go on to Section 2.1.2.

2.1.1. Libusb

Libusb is a library that allows access to the USB functions in Linux through userspace and without the need to enable kernel support and insert modules. Most distributions, at this point, are offering libusb in their stable branches (and some install it by default), so if you don't already have kernel support for USB devices, then you may only have to install the libusb package in order to access your device. You must have USB device filesystem support enabled in your kernel, which most distributions do. To find out for sure, issue the following at the command line:

```bash
$ cat /proc/filesystems
```

You should see (among others):

```plaintext
nodev   usbdevfs
nodev   usbfs
```

You may need to mount usbdevfs to enable it and see the device files, which you can do at the command line with `mount -t usbdevfs none /proc/bus/usb`. Don't try to use libusb while your particular kernel webcam support is enabled either statically or the module loaded; you can only use one at a time.

You can obtain the libusb package in `.rpm`, `.tgz` or `.deb` format from your Linux distribution.

2.1.2. Linux Kernel USB Support

Kernel support is required for USB webcam support (if not using libusb). Your stock kernel may already have support for what you need and the way to tell is to use the `dmesg` command and look for an acknowledgement that the driver in question was loaded at bootup. In general, USB webcams require the module `usbvideo` to function. If you don't see it, the driver may be present (but not necessarily loaded) as a module. To find out, you can type the following at the command line:

```bash
$ ls -R /lib/modules/X.XX/kernel/drivers
```

Where 'X.XX' is your kernel version number. The following output is an example of what you might find in a USB webcam-ready kernel, where everything is loaded as a module (though all but the relevant lines have been edited for brevity):

```plaintext
./usb:
    usbvideo.o
    usbccore.o
    ibmcam.o
```
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(A hint for newbies: if the info in dmesg or the above module list scrolls by too fast, you might try piping the output into 'less' (or 'more' if you don't have less): ls -R /lib/modules/X.XX/kernel/drivers | less or alternatively catching it in a file: ls -R /lib/modules/X.XX/kernel/drivers > file.txt, where 'file.txt' will contain the info that can then be accessed with cat [file] | less.)

If your kernel doesn't contain the necessary support, you can always recompile your kernel. If you are unfamiliar with the process of compiling your own kernel, I direct you to the Kernel HOWTO for more information.

For generic USB bus support in Linux, you will need USB subsystem support in your kernel, whether usb-ohci, usb-ehci, or whatever flavor of USB driver your system prefers. USB subsystem support has been present in the Linux kernel since the late 2.2 series. For a more in-depth discussion of USB support in general, I direct you to the linux-usb project site. If you want to find out which modules are loaded, at the command line or in an xterm, type the following:

```
# lsmod
```

As shown by the prompt above, you will need to have root privileges to do this. You should get output similar to the following:

```
    cdrom                  29312   0  (autoclean) [sr_mod]
    usb-ohci               17888   0  (unused)
    usbcore                56768   0  [scanner ibmcam usbvideo usb-ohci]
    ibmcam                 39680   0
```

If you don't have the particular module you're seeking loaded and you know you have it included as a module in your kernel, try loading it directly (using the usb ibmcam module as an example):

```
# modprobe -v ibmcam
```

...at which point you should see something like the following:

```
Using /lib/modules/2.4.20/kernel/drivers/usb/ibmcam.o
```

By placing the entry ibmcam (for example) in /etc/modules (note that this varies by distribution), you can have the module load at boot-time automatically. You can then confirm the module was loaded by checking the syslog or in the boot-time record with dmesg | less), where you should see an entry such as the following:

```
Oct 18 12:43:12 K7 kernel: hub.c: new USB device 00:02.3-2, assigned address 3
Oct 18 12:43:12 K7 kernel: ibmcam.c: IBM PC Camera USB camera found (model 2, rev. 0x030a)
Oct 18 12:43:12 K7 kernel: usbvideo.c: ibmcam on /dev/video1: canvas=352x240 videosize=352x240
```

2.2. IEEE 1394 (Firewire", i.Link")

IEEE 1394 webcams require an IEEE 1394 PCI card in your computer for access. The IEEE interface has been supported in Linux since the early 2.4-series kernel. If you are lucky enough to own such a device, generic information on support of the IEEE 1394 bus in Linux can be found at www.linux1394.org. If you have a kernel older than 2.4.2, you will need to patch your kernel with one of the patches found on this page.

2. Supporting the Connection Type
matched to your kernel version. In addition, you will require libraw1394. The previously referenced
linux1394.org site has a great installation guide.

The IEEE1394 Digital Camera List, by Damien Douxchamps, offers an outstanding summary of the
capabilities of IEEE 1394 cameras as well as the current status of support for individual models.

2.3. Generic Parallel Port Support for Parport Webcams

For 2.2 and 2.4 kernel systems, parallel−port support must be enabled statically or as a module (stock kernels
usually have this enabled by default). You may want to read more generic info about parallel−port device
support under the Linux kernel before starting this process. To find out for sure if the module parport is
loaded, you can check the dmesg file or use lsmod as outlined above. Using dmesg | less, you should see
(among many other lines) the following:

| Mar 3 08:00:25 K7 kernel: parport0: PC−style at 0x378 (0x778) [PCSPP,TRISTATE] |
| Mar 3 08:00:25 K7 kernel: parport0: irq 7 detected |

If you are compiling your own kernel, enable 'Parallel Port support'. You should enable 'IEEE 1284 transfer
modes', and if you have x86 type architecture, you should also enable 'PC−style hardware'.

If modprobe returns an error when you attempt to load the module, note that you may need to determine and
supply the hardware address when invoking modprobe. The most common address is 0x378 for an x86
system; 0x278 and 0x3BC are other possibilities for integrated or ISA parallel ports. Add−in PCI parallel
ports may have unusual base addresses. You can also arrange multiple devices with either the parport_pc or
parport_arc modules, though that topic is beyond the scope of this document. WARNING: Be sure you have
the correct address before entering this information at the command line or else your machine may become
unstable, crash or otherwise implode.

Your parallel port should be set to preferably "EPP" mode, or alternatively ECP/EPP. "Bidirectional" (also
known as "BPP" or "PS/2") may work, albeit much more slowly. "Unidirectional" mode is unsuitable for
scanning. The above setting can usually be accessed through your BIOS menu, at least on x86 systems.
3. Making and Accessing the Video Device

3.1. Device Filesystem

Devfs, or 'device filesystem', has been an option in the Linux kernel since the late 2.2 series. If you haven't used it up to this point, then I would suggest you at least consider it. It can immensely simplify device management. Devfsd, the device filesystem daemon, creates and removes devices on your system dynamically without the need for user input. You can tell if your system is running devfsd if you run `ls -f /dev/` at the command line or in an xterm, and see mostly symlinks pointing to a device file, or "node" within a logically ordered hierarchy of subdirectories within /dev. You can also see devfsd running when you check running programs with `ps -A` at the command line. The daemon consumes very little memory. If you are running devfsd/devfs, you can probably skip the following sections as the archaic process of creating device nodes will be done for you, and it's simply a matter of finding the device by selecting the appropriate symlink in /dev.

If you want to give devfs a try, you need to enable '/dev file system' and 'Automatically mount at boot' in the 'File Systems' section of kernel configuration. Yes, it absolutely requires a recompile of your kernel if you don't have it in there already. **WARNING:** The only other supporting package required is 'devfsd', which you can obtain from your distribution vendor. **WARNING:** If you enable devicefs to automatically mount at boot-time without installing the devfs daemon, you will be left with an unbootable system!

Devfs does not obviate the need to change permissions of devices for access by users.

Naturally, the above comments about devfs are the opinion of your humble author (among others) and should be treated as just that, especially if you are a relative newbie or are not quite ready to compile your own kernel.

Beginning in the 2.6 series kernel devfs has been deprecated in favor of a userspace (i.e., non−kernel) daemon known as udev, though devfs remains as an option. You can find information on udev [here](#) if you are inclined to live on the bleeding edge.

3.2. Creating Video Devices Manually

If you aren't running devfs and devfsd, this is how it will need to be done, unless you are using libusb or udev in which case you can skip this step. A device can be created as a block (such as a drive), a fifo (file−in−file−out or pipe, as in xconsole) or a character device, which represents other hardware. Each device has a major and a minor number "coordinate" to tell the kernel what it is and where to access it. These numbers are not arbitrary.

Video4linux device nodes are used to access video devices (including webcams) and have the major number 81 and minor number 0, 1, 2, etc... First, check /dev to see what directory your distribution lays out its video devices in. Some distributions might have the video device(s) in the root /dev directory, such as /dev/video0, /dev/video1...and so on. Others might place them within /dev/v4l or in /dev/video. If you find that the video devices are already present (made by your distributor or devfsd) then your work is done except for possibly permissions. If not, you will need to create the device nodes yourself. You can use the following script, which I have borrowed from the kernel source (located in `linux/Documentation/video4linux/bttv/MAKEDEV` of the source tree):

---

3. Making and Accessing the Video Device

---
#!/bin/bash

function makedev () {
    for dev in 0 1 2 3; do
        echo "/dev/$1$dev: char 81 $[ $2 + $dev ]"
        rm -f /dev/$1$dev
        mknod /dev/$1$dev c 81 $[ $2 + $dev ]
        chmod 666 /dev/$1$dev
    done

    # symlink for default device
    rm -f /dev/$1
    ln -s /dev/${1}0 /dev/$1
}

# see http://roadrunner.swansea.uk.linux.org/v4lapi.shtml
echo "*** new device names ***"
makedev video 0
makedev radio 64
makedev vtx 192
makedev vbi 224
# "*** old device names (for compatibility only) ***"
#makedev bttv 0
#makedev bttv-fm 64
#makedev bttv-vbi 224

Simply copy and paste the above into your favorite editing program, save it as MAKEDEV or whatever name you like and then make it executable (i.e., `chmod u+x MAKEDEV`). Next, execute it as root:

```
# ./MAKEDEV
```

### 3.3. Groups and Permissions

It is a good idea to be sure that your user account can access the device once all modules are loaded and device nodes created. The most security-conscious way to do that is to add access for a particular group. On my system, the members of the group 'video' are allowed to use the webcam, scanner and other photographic devices. The way to accomplish this is to first change the ownership of the devices in `/dev` like so (as root):

```
# chown root.video /dev/usb/video1*
```

...where `root.video` are the owner and group the device will now belong to. Obviously, the specific command will vary by your system and the type of device. It is important that you change the ownership of the device node itself and not the symlink; symlinks' ownerships are affected only by changing the parent devices or files they point to.

To see if your user account is a member of the group in question, as root issue the following command: `grep -e video /etc/group`. You should see something like the following:

```
video:x:44:
```
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...where '44' is the group number. Since no members follow the last colon in the 'video' group, we can add them, let's say user 'jhs' with the command

```
# adduser jhs video
```

After this, it's simply a matter of allowing read and write access for the user in question of the device like so:

```
# chmod g+rw /dev/v4l/video0
```

...where `g+rw` means add read and write access for group. See the documentation for `chmod` (`man chmod` or `info chmod`) for further info.
4. Specific Webcam Models

Note that this information is frequently changing. The Linux–USB Device Overview site is a great place to look if you have a USB webcam. Also, you will want to check for your model's homepage at http://www.exploits.org/v4l/. The information compiled below on specific webcam models is from the same source, so you may find more up-to-date information through the previous link. If you can't find an entry for your particular hardware, you can find links to resources on how to write your own driver!

*It is important to note that if your camera isn't listed, the easiest way to find out if your camera is supported is to find out what chipset is used in its manufacture.* This information is usually present in the specifications published in your webcam's manual or on the manufacturer's website.

If you can't find your camera model listed and aren't sure what chipset your camera is made with, you should consider searching and/or subscribing to the video4linux–list mailing list hosted by Redhat.

### 4.1. 3com HomeConnect PC Digital Webcam

This driver is supported with the kernel patch located at the homeconnectusb project web page. It may require a kernel recompile after patching depending on your kernel version.

### 4.2. CPIA based Webcams

Please see the project home page for up-to-date information. This chipset has been used in the manufacture of both USB and parallel port webcams including the following:

- Aiptek HyperVcam Fun USB (non–OV511 based)
- Creative Video Blaster WebCam II USB and parallel–port
- CVvideo–Mail Express parallel–port
- Digicom Galileo USB and Digicom Galileo Plus
- Dynalink Digital Camera
- Ezonics EZCam (not Pro or Plus)
- I–View NetView NV200M
- Microtek EyeStar USB
- Pace Color Video Camera USB
- SuperCam WonderEye
- TCE Netcam 310 USB
- Terracam USB (non–OV511 based or Terracam Pro)
- Trust SpaceC@m Lite USB and SpaceC@m 100
- Utopia USB Camera
- ZoomCam USB and parallel–port

### 4.3. SE401, SE402 and EP800 based USB webcams

This project is a work in progress. The drivers and other useful information are available at the project homepage located at [here](#). As of writing this, it is necessary to patch and recompile your kernel in order to obtain support for these models. The driver supports the following:

SE401 chipset via the 'se401' driver:
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- Aox SE401 camera
- Philips PCVC665 USB VGA webcam 'Vesta Fun'
- Kensington VideoCAM PC Camera (Models 67014–67017)

SE402 and EP 800 chipsets via the 'epcam' driver

- Spypen Actor
- Rimax Slim Multicam
- Concord Eye–Q Easy
- Creative PD1001
- Chicony DC–100
- Endpoints SE402 and EP800

4.4. OmniVision based Webcams

This category includes a multitude of webcam and video–capture devices manufactured by Omnivision, including the OV511(+), OV518(+), OV6620, OV6630, OV7610, and OV7620AE. The project homepage is here. Supported models include:

- Aiptek HyperVcam Home and Mobile
- Amitech AWK–300
- I–view NetView NV300M
- TEVion MD9308
- Intel Me2Cam
- Dlink DSB C100, C300
- Hawking Tech. UC–110, UC–300 and UC–310
- Puretek PT–6007
- Alpha Vision Tech AlphaCam SE model AC–520
- Creative Labs WebCam model PD1001 with OV518 chipset
- Creative Labs WebCam 3, WebCam Go, Webcam Go Plus
- Elecom UCAM–C1C20
- Elta WEBCam 8211 PCC
- Ezonics EZPhone Cam
- Philips ToUCam XS (old version with OV518)
- LG Electronics LPC–UM10
- Lifetview various USB Life TV models
- Genius VideoCam Express
- AverMedia InterCam Elite
- Maxxtro Cam22U
- MediaForte MV300, PC Vision 300
- Terratec TerraCam PRO and some TerraCam models
- OmniVision (except those with OV519)
- TRENDNet TV–PC301
- Trust Sp@ceC@m USB
- Lifetec LT9388
- BestBuy EasyCam U
- Maxell Maxcam
- TCE NetCam 310u
- Medion MD9388
- Webeye 2000B
4.5. Logitech (formerly Connectix) Quickcam Support

The QuickCam VC USB and parallel port model webcams are supported by the driver offered [here](#). A kernel patch and recompile are necessary for support of this model.

The Quickcam Express Linux project offers two different flavors of driver for certain Quickcam models, both of which are stand-alone drivers that do not require a kernel patch or recompile. The qce-ga and qc-usb drivers support the following models:

- Logitech Quickcam Express
- Quickcam Web
- Legocam
- Dexxa Webcam
- Labtec Webcam

The qc-usb driver is more experimental but reportedly works better on some models such as the Quickcam Web. See the above links for more information. Note to Redhat users: The qce-ga driver doesn't compile properly using the modified kernel source provided in Redhat 9, but a fix is available [here](#).

Some Logitech camera models are supported by the Philips driver in Section 4.7.

4.6. NW802 Based Webcams

This chipset, manufactured by DIVIO, is supported by the driver found [here](#). The models supported include the following:

- BTC SurfCam CMOS300k
- Mustek WCam 300
- Logitech QuickCam Pro USB (the earlier "dark focus ring" model)

4.7. Philips USB Webcams

Supported Philips models include the following. The up-to-date PWC driver and list can be found at the project homepage.

- PCA645VC
- PCA646VC
- PCVC675K Vesta, Vesta Pro and Vesta Scan
- PCVC720K/40 ToUCam XS, ToUCam Fun, ToUCam Pro and ToUCam Scan
- Askey VC010
- Creative Labs Webcam 5, Pro Ex
- Logitech 3000 and 4000 Pro, Notebook Pro, and Zoom
- Samsung MPC-C10 and MPC-C30
4.8. STV0680 based Models

The USB version of webcams made with this chipset are supported by the 2.4.18 and above kernel with the stv680.o module. Alternatively, you can obtain the source from the project homepage. This driver supports models including the Aiptek Pencam and the Nisis Quickpix 2.

If you have a serial version, the main one of which is the Scan e−Studio, you should go here.

4.9. Winbond w9966cf

This is a driver for the parallel−port interface that supports the Philips SAA7111 CCD−control chip as found on the Lifeview Flycam SUPRA webcam. It is included in the late 2.4 kernel series and later under the heading 'video4linux' support. The homepage for this project is here.

4.10. Xirlink C−it" HDCS−1000 based Webcams

This driver is for the USB webcams manufactured by Xirlink, IBM (PC Camera) and Veo Stingray model webcams. Support has been in the linux kernel USB section since 2.2.12. The homepage is at http://www.linux−usb.org/ibmcam.
5. Framegrabbing Applications

5.1. Xawtv

Xawtv is a suite of tools available for accessing video devices in Linux, the workhorse of which is the Xawtv program itself. The home page is at [http://bytesex.org/xawtv](http://bytesex.org/xawtv). You'll probably want to install an already packaged rpm, tgz or deb of xawtv; though, courageous or curious types can always get the latest source from the previous link.

When you first try out your webcam, and you think things are configured right, use the `−hwscan` option:

```
$ xawtv −hwscan
This is xawtv-3.72, running on Linux/i686 (2.4.21)
looking for available devices

/dev/v4l/video0: OK       [ −device /dev/v4l/video0 ]
type : v4l
name : BT878(Hauppauge (bt878))
flags: overlay capture tuner

/dev/v4l/video1: OK       [ −device /dev/v4l/video1 ]
type : v4l
name : IBM USB Camera
flags: capture
```

...so now you can see the available devices (your output may differ substantially). Try opening an xterm and running xawtv, grabbing from your webcam video device:

```
$ xawtv −c /dev/video1
This is xawtv-3.72, running on Linux/i686 (2.4.21)
```

...and (hopefully) your camera will begin capturing to a window on your desktop. You may see some error messages in your xterm if things don't work that can be helpful to diagnose configuration problems. If you aren't interested in all that, and things work for you, launch from your window manager's menu next time. You can read about more xawtv options with `man xawtv`.

5.2. MoTV

MoTV is a rewrite of Xawtv using the Motif toolkit, and as such functions similarly to Xawtv. It looks more polished but otherwise differs very little from Xawtv. You can get it from the Xawtv home page.

5.3. Streamer

Streamer is a versatile program that allows a capture from a webcam or video device using only the command line. It may be in your Xawtv package already (or may need to be fetched separately as in Debian), and is available at the Xawtv homepage referenced in Section 5.1. It is a great program for automating camera functions. For example, to take a standard JPEG picture from the command line where the camera is accessed through `/dev/video1:`
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```
$ streamer -c /dev/video1 -b 16 -o outfile.jpeg
```

...where `-b` is the number of colors (in bpp, whether 15, 16, 24 or 32) and `-o` is the output filename that will be dropped into the current directory (specify `-o /path/outfile.jpg` to place it elsewhere).

To make an .avi file:

```
$ streamer -q -c /dev/video1 -f rgb24 -r 3 -t 00:30:00 -o /home/jhs/outfile.avi
```

...where `-q` is for 'quiet' execution (no message output), `-f` is 'format' (rgb24 is TrueColor avi), `-r` is the frames per second and `-t` is the time of recording (30 minutes). Streamer can capture raw and Quicktime" (non–Sorensen) formats and can capture audio as well. See `streamer --help` for more information.

5.4. Motion

Motion is a brilliant program that is able to monitor the video signal from one or several webcams. It can record periodic snapshots, and when motion is detected, record an mpeg and/or perform another action such as sending an email or executing a command. It can track and graphically mark the motion it detects, feed files via an http server to your website, stream them to another application and more. It is accessed through the command line and the number of options may be intimidating; there is however, a guide available online that outlines the various command and configuration file options nicely. The motion homepage can be found at http://motion.sourceforge.net.

5.5. Gqcam

Gqcam is a graphical GTK+-based application originally written to access Connectix QuickCams but now supports nearly all Video4Linux compatible webcam devices. It has an intuitive interface that makes viewing, taking snapshots, and configuring webcam settings blissfully easy. It is highly recommended for newbies and those who only want to look at the camera and take a picture here and there without editing a configuration file or using the command line.

5.6. camE

CamE is a command-line program that works in daemon mode to capture frames from your v4l device for archive or upload (to a webservice, for example) via ftp or scp. You can overlay other graphics, timestamp the frames, or add other dynamic text all by altering the appropriate line in the configuration file. See the camE homepage for more information.

5.7. SANE

SANE, or Scanner Access Now Easy, supports access of cameras including webcams in later versions. If you are familiar with using a photographic scanner device in Linux, you may be interested in using SANE for image capture, especially since a few devices double as both scanners and digital cameras. See the relevant sections of the Scanner–HOWTO here.
6. Troubleshooting

6.1. Help, How do I figure out what my USB camera chipset is if the model isn't listed in your HOWTO?

If you have a usb camera (and `/proc` filesystem support and usb−filesystem support), issue the following at the command line:

```
$ cat /proc/bus/usb/devices
```

You should receive output including (but not necessarily limited to) the following:

```
T:  Bus=01 Lev=01 Prnt=01 Port=01 Cnt=01 Dev#=  3 Spd=12  MxCh= 0
D:  Ver= 1.01 Cls=ff(vend.) Sub=ff Prot=ff MxPS= 8 #Cfgs=  1
P:  Vendor=0545 ProdID=8080 Rev= 3.0a
S:  Product=USB IMAGING DEVICE
```

The line beginning "T:" is the USB bus the device is attached to. The "P:" indicates (obviously) the vendor and product ID, which are catalogued at the linux USB Project homepage.

6.2. Help, I can't find the camera device in `/dev`!

Assuming your connection type is supported, and your camera is working, see Section 3.2.

6.3. Help, I can see the camera device, but I can't access it!

See Section 3.3.

6.4. Help, my camera has a driver that is source−only, i.e., has to be built by me! Where do I start?

First, check if your Linux distribution offers a pre−compiled binary of the driver. If that is not the case, be sure you have kernel sources installed. You will also need at a minimum GNU make, gcc, binutils and perhaps other programs installed depending on your distribution. Download the driver source (in this example named `src.tar.gz`) and uncompress/untar it:

```
$ tar -xvzf src.tar.gz
```

Then, change to the directory of your kernel source:

```
# cd /usr/src/linux
```

Make the necessary source files:

```
# make oldconfig
# make dep
```
Now, change to the directory where you unpacked the driver source and read the README and/or INSTALL files for instructions on how to make the driver. Usually this involves some combination of "make" "make all" and/or "make install." Assuming it compiles correctly, you can simply load the new module with modprobe. If you have any problems, see Section 6.6.

### 6.5. Help, my camera is supported by a driver that has to be patched into my kernel! What do I do?

See the section on patching of the Kernel−HOWTO at The Linux Documentation Project.

The short and unguaranteed version of patching, by your humble author, goes as follows: Be sure you have the same prerequisites outlined in Section 6.4 installed. First, on the command line or in an xterm change to the source directory of the kernel version you are (or will be) running with the camera patch (in this example named patch.diff).

```bash
# cd /usr/src/linux
# patch -p1 -E patch.diff
```

You should see a confirmation that the 'hunks' were successfully applied. At this point, you can make menuconfig or whatever program you use to recompile, enabling the appropriate support. If any of the hunks failed, or you run into any problems in addition to the link referenced above you, should consult man patch and Section 6.6.

### 6.6. Help--as in, where can I get more of it?

See the video4linux mailing list headquarters at https://listman.redhat.com/mailman/listinfo/video4linux−list.

### 6.7. Help, I want to contribute to Video4Linux support in Linux! Who do I get in touch with?

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