Linux-compatible hardware components

PLUGGED IN PENGUIN

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Driver or no driver? – that is the question for the newcomer to Linux who wants to treat their computer to the free operating system. The driver coverage for PC components is certainly very extensive. But simply buying a piece of hardware blind can lead to great annoyance. This can be avoided.

Until a few years ago, there were very few manufacturers willing to offer Linux drivers for their hardware. For this reason, a powerful army of voluntary programmers have been beavering away at device support – provided the manufacturer will issue the information necessary for the programming. But with a growing market share, manufacturers can no longer ignore the wishes of their customers and there is a clear trend towards factory-installed Linux drivers. This development, which is in itself praiseworthy, does however have its dark side: The drivers are often only available as proprietary solutions in binary format. This means that Linux distributors have little chance of adapting the driver to their product. Plus, the manufacturer's driver programmers seldom have sufficient time to upgrade and improve the software as appropriate. Result: the drivers (such as that from nVidia) are often under-developed and the stability of the operating system suffers considerably. This is why the user should settle for a device whose device driver is available in source code. Most users don't even know where to start with this. But the few who, out of pure curiosity, dare to reach programmer level usually make a valuable contribution in the form of bug-fixes or at least very exhaustive bug-reports, which help the driver developers to get the piece of software into a stable condition. Generally, therefore, when buying new hardware for a Linux system:
first look on the Internet, to see if the device you want will also do its duty under Linux. There are plenty of informative starting points. Table 1 shows a few revealing sources for the respective driver requirements.

If you don't find your devices here, don't give up straight away, but ask your favourite search engine. If this too fails to find what you want, you could turn with confidence to the Linux hardware newsgroup comp.os.unix.linux.hardware. Check before sending a **posting** whether the question has not recently been posed and answered.

Linux inclusive

Internet searches are very time-consuming, though – and time is money, as we all know. So in Germany a few PC manufacturers (in some cases, for a considerable time) have been including well-specified computers with pre-installed Linux in their range of products. Of course, with a system like this, you can expect all the integrated components to be completely compatible with the operating system delivered.

For good reason, the complete-system manufacturers very rarely use *noname*-products for

Posting: *an article published in a newsgroup.*
OS: *short for Operating System*

their Linux packages, as the big-name component makers can no longer ignore the ever-growing Linux market. Obviously the manufacturers also want to get in on the act, even if only by providing information on the hardware-related register programming, so that driver development by third parties is possible. After all, one does have a reputation to lose (as did the company *Adaptec*, at the mention of whose name die-hard Linux cognoscenti still wrinkle their noses).

False economy

No-name Chinese and Taiwanese products for the end-user mass market, such as those found piled up high and sold cheaply in supermarkets, do make new computers cheaper than ready-made Linux PCs, but they are certainly not as compatible with the free **OS**, since this is where the card manufacturers often play dumb and display no inside details about their cards – in the false assumption that this will give them a competitive advantage in the tough world of market shares.

Anyone who has already got a supposed bargain on his desk, and is now having to buy Linux-compatible components as well – because the multimedia hardware which came with it is refusing to do its duty – will very soon recall the saying: "You get what you pay for".

Cheaper?

A little tip for any hardware specialists who want to build their system up themselves: Apart from a look at the support databases or the Web sites of the respective hardware projects (see Table 1) one can of course also take a peek at the Web pages of the Linux-PC integrators. This is, after all, where individual components of systems which have undergone the acid test are listed. Adding on hardware is of course not yet prohibited – whether do-it-yourself or by commissioning the PC Mister fix-it around the corner. In the latter case, though, the price difference to the example may turn out so low that at best, proximity to a more or less competent dealer might come out in favour of this solution.

Coming to terms with it

Appropriate local specialist shops are also a good place to start for those customers who are uncertain but willing to buy. Many dealers' technical departments have already seen the way the wind is blowing and can help you out with good advice. If the dealer does not know if the hardware is Linux compatible or not, it is not uncommon for an eight to 14-day returns policy to be granted if required. This is because the new hardware components cause problems in your home computer.

Yet other shops are leading by good example and are already referring in their (online) price lists to the impeccable implementability of their products in combination with Linux.

PCI vs. ISA

So far we have been assuming that a spanking new computer with Linux is to be used alone or (more realistically) in parallel with another, also very commonly found, operating system. This is where, when it comes to buying new, the reins are in your hands. But quite often Linux newcomers (e.g. after buying a PC supermarket bargain) want to upgrade their old second computer into a Linux Box.

In computers of the older type of construction PnP cards (*Plug & "Pray"*) or ISA-cards often scrape a living with mechanical jumpers. Linux does in fact tolerate almost all (PnP) network cards, although old (PnP) sound cards often only run in Soundblaster, rarely also in Windows soundsystem compatibility mode.

There are no Linux drivers for really exotic graphics cards (put better: *X-servers*) The integration of PCI cards into the Linux system is far less problematic than in ISA bus cards. PCI cards can announce their demands and capabilities in the PC-BIOS (incidentally, this is a technique that already existed 16 years ago with the Amiga).

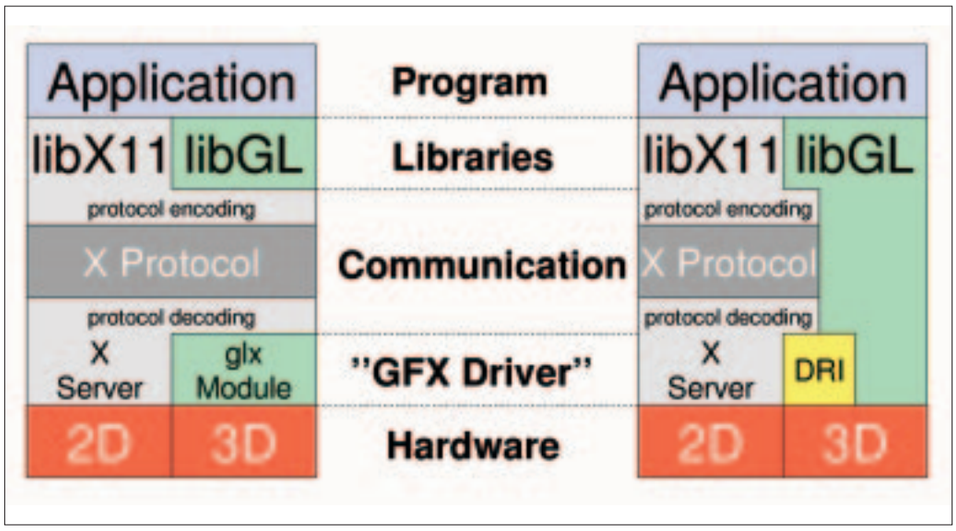
ISA cards on the other hand have to be *probed* for automatic recognition. But this could lead to crashing and in the worst case to loss of the file system. For this reason, with such hardware components at least the I/O basic address must be specified when loading the driver module.

Autodetect

PCI/AGP cards have a unique *Vendor* and *Device* identification number (ID). The installation programs of the distributors can therefore very easily assign the PCI card to the kernel driver and as a result automatically configure the hardware detected in the Linux installation.

In the case of old ISA bus or brand new PCI or AGP cards (which are not yet entered into the assignment table) the associated driver must be specified manually with one of the configuration utilities provided (e.g. *linuxconf*). Many Linux newcomers have no end of trouble with this, as the drivers often have names which superficially have nothing to do with the product name or the chip working on the card.

Two examples: the driver *tulip.o* must be used for network cards with the *DEC21143* Ethernet chip. To set this one uses a configuration tool or manually enters the line *alias eth0 tulip* in the file */etc/conf.modules* (*eth0* stands for Ethernet Device 0). The *Creative Labs PCI128* is downwardly compatible with the *PCI64V* – the latter has a component with the designation *ES1373*.



GLX vs. DRI: 'Direct' means the graphics output is faster

At present though, there is only the module *es1371.o* for SB PCI64, which however can be used for all three Soundblaster cards mentioned. But this does not exhaust all the functions of the cards completely. Apart from free sound drivers (Table 1: *ALSA*) there are also some commercial ones (*OSS/Free*).

Win or lose

Hardware with the prefix or suffix win in the product name (e.g. *WinModem*) is generally very difficult to persuade to co-operate with Linux, as their manufacturers prefer a different OS. Praiseworthy exception: For Softmodems based on the Lucent chip there is a stable kernel driver.

Generally, new consumer devices which formerly had their functionality reside on the chip are increasingly having it realised by cheaper software. This means accepting a higher processor load because of the extra burden imposed on digital signal processing.

Since this often means using US-patented algorithms and/or the (sometimes bought in by manufacturers) copyrighted source code, things are looking pretty bad for Linux hardware drivers.

Graphics cards (2D)

In the case of Linux the graphics card driver is very different from the kernel drivers for SCSI, Ethernet or Sound. For the screen output, there really are no proper drivers which would be part of the operating system, but a powerful program – the X-Server – which accepts graphics commands via the X11-**protocol** and then writes directly in the register of the graphics card.

Application programs send their illustration requirement using an X11-based **GUI-toolkit** (e.g. Qt or GTK) to the X-server. As a result the application (the X-client) can run on a powerful applications server – only illustration is done separately on a (old and) weak client computer (on which an X-server is running – the confusion of terms is now complete).

This architecture also has the advantage that the complex and error-prone graphics driver runs in the so-called *user-space* and can profit from the memory protection mechanisms of the processor. An X-server will at worst cripple the console. In a free-standing home computer even this is fatal, but in a network server at least the Web /FTP/mail/file services would still continue to run as needed. The X-server which runs amok can usually be started again by remote control – one simply has to log in using *ssh* or *telnet* on to the problem computer.

A faulty sound or network kernel driver in the *kernel space* on the other hand can freeze up the whole computer. But this happens only very rarely with Linux (in drivers at the test-stage).

For almost all current and older graphics cards there are appropriate X-servers. It is only in the case of brand new products that one ought to make enquiries first about downwards

Table 2: Five commandments for buying hardware

1.	Before buying, check for Linux compatibility on the Internet (see Table 1)
2.	Consider buying a complete PC system with factory-installed Linux
3.	Negotiate with the dealer before buying to agree he will take it back if it does not work properly
4.	Setting up cheap No-name components often costs heavily in terms of time and patience – so avoid it!
5.	Supermarket bargains usually include one or more Linux incompatible components or onboard elements

Protocol: *A standardised language, with which computer and (service) programs in a network communicate. The network in this case consists of just one computer. One then talks of a Loopback.*

GUI-Toolkit: *GUI-toolkits provide programmers with (user)elements for programs with graphical user interfaces. This means the toolkit used (as well as the cleverness of the programmer) decides how user-friendly a program will be.*

Multihead-Support: *Support for several monitors on one computer, which show different parts of the image created by the graphics card*

Patch: *Software repairs, which correct errors or add on a functionality. When the Linux operating system kernel is fixed up with patches this allows the use of hardware which was previously not supported by the stable user kernel.*

compatibility. This means the latest tool may not be perfectly refined, but at least you get more than just a text console.If there is no free XFree86 server to support your special card, then you could try contacting third party manufacturers such as *Xi-Graphics* or *Metro Link*. These can supply the commercial X-server families *AcceleratedX* and *MetroX* – for the average Joe user these are certainly not cheap but on the other hand are equipped with **multihead-3D-support** (e.g. for *Matrox G400 DualHead*) and other things.

If all else fails with a brand new graphics miracle, at least you can usually use the free Framebuffer X-Server. This X-server attaches directly on to the VESA2.0/3.0-BIOS functions of the card. This means even resolutions of up to 1280x1024 at 76 Hz screen refresh rate are possible – but unfortunately not accelerated. The option of the KDE window manager *Move window with content* should therefore be deactivated.

Rosy future

Certainly, the hardware manufacturers mainly want to make a fast buck from the Windows user, but Linux has also already captured a solid market share. In particular, in the professional network and server field, Linux drivers are almost always immediately available now when new items of hardware come out.

As the desktop steadily improves, Linux is also starting to be of interest for the consumer market, which will obviously mean the hardware manufacturers are increasingly spurred to action with their own drivers – just as happened in the past with ATI, CreativeLabs, nVidia and Hewlett-Packard. ■

Table 3: Rules of thumb for hardware support

1. <Linux runs in principle on 386SX processors and above with at least 2MB of mainmemory. For Mandrake Linux, a computer in the Pentium class with 64MB (better 128MB) main memory is recommended. Motherboards with onboard components are to be avoided, unless it is known that all are supported one hundred percent by Linux.
2. For almost all (Raid) SCSI, network and graphics cards (2D) there are suitable Linux drivers – though sound cards should be enjoyed with care.
3. USB devices can currently only be operated under Linux with patches – the Linux newcomer should steer clear of these. USB support will not be integrated until Kernel 2.4 (coming in the first quarter of 2001).
4. SCSI scanners and CD burners are very well supported by Linux. But in the case of the parallel port or ATAPI versions, the chances look a bit slim.
5. Brand-new, megacool hardware is highly unlikely to function with Linux, or only to a very limited extent. But drivers are often available two to three months after the market launch.

Where to start looking on the Internet

Source	Driver	URL
Graphics		
XFree86 Project	free X-server ("graphics driver")	*http://www.xfree86.org/*
DRI project	3D-acceleration for XFree86-4.0	*http://dri.sourceforge.net/*
Utah-GLX project	3D-acceleration for XFree86-3.3.6	*http://utah-glx.sourceforge.net/*
Xi Graphics	commercial X-Server	*http://www.xig.com/*
Metro Link	commercial X-Server	*http://www.metrolink.com/*
Nvidia	Detonator-Driver for Nvidia-Chips	*http://www.nvidia.com/Products/Drivers.nsf/Linux.html*
3dfx	Glide driver for Voodoo and Banshee Chips	*http://linux.3dfx.com/*
Matrox	3D and Multihead drivers for Matrox cards	*http://www.matrox.com/mga/support/drivers/files/linux_03.cfm*
Linux3D	Daryll Strauss' links collection on 3D graphics card drivers	*http://www.linux3d.org/hardware.html*
Sound		
4FrontTech Open Sound System	commercial sound card drivers	*http://www.4front-tech.com/linux.html*
OSS/Free	free sound card drivers	*http://www.opensound.com*
ALSA-Project ("Advanced Linux Sound Architecture")	alternative free sound card drivers project	*http://www.alsa-project.org/*
Multimedia		
Multimedia4Linux	Holger Klemm's infosite for TV and framegrabber cards (etc.)	*http://www.multimedia4linux.de/*
Video4Linux	Driver for TV, Framegrabber, MPEG and DVD cards	*http://www.linuxvideo.org/*
Peripheral devices		
SANE-Project ("Scanner Access Now Easy")	Scanner software and drivers	*http://www.mostang.com/sane/*
Ghostview	Printer drivers	*http://www.cs.wisc.edu/~ghost/printer.html*
Linux-USB project	Linux drivers for USB devices	*http://www.linux-usb.org*
Linux Winmodem Support Project	Driver for Lucent Winmodem chips	*http://www.linmodems.org*
CD burners		
gcombust	burner software	*http://www.abo.fi/~jmunsin/gcombust/*
xcdroast	burner software	*http://www.xcdroast.org/*
Compatibility lists		
SuSE-Hardware databank	various for SuSE Linux 7.0	*http://cdb.suse.de/*