Linux PCI-HOWTO

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Information on what works with Linux and PCI-boards and what does not.

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1 Introduction

Many people, including me, would like to run Linux on a PCI-based machine. Since it is not obvious which PCI motherboards and PCI cards will work with Linux and which do not, I conducted a survey and spent some hours to compile the information contained herein.

If you have information to add, please mail me. If you have questions, feel free to ask.

Help with my style/grammar/language is welcome as well. I am not a native- speaker of English and expect to make occasional mistakes.

Note: "on-board chip" refers to a SCSI chip integrated onto the motherboard rather than on a PCI expansion card.

Also, "quotes" herein may have slight context editing.

2 Why PCI?

2.1 General overview

The PC-architecture has several BUS-Systems to choose from:

ISA

cheap, slow (usually 8Mhz), standard, many cards available¿

EISA

expensive, fast, some cards available¿

MCA

ex-IBM-proprietary, fast but not very wide-spread¿

VESA-Local-Bus

based on ISA, cheap, fast, some cards available¿

PCI-Local-Bus

expensive, fast, some cards available, the upcoming standard¿

ISA/VESA-Local-Bus had some problems with high bus-speeds, and was not very reliable, but mainly due to its low price and better-than-ISA performance, sold very well. Most VESA boards should be stable by now.

EISA was reliable, but rather expensive, and intended more for power-users and servers, than for the average user. It has fewer cards available than other busses.

PCI now has the advantage. Like EISA it is not proprietary. It is as fast as EISA (or even faster), and 64bits wide. This will be important with the i586 (That Intel would prefer we call the Pentium...).

PCI is not like ISA/Local-Bus processor-dependent. This means you can use the winner-1000-PCI in an Alpha-driven-PCI-board as well as in a i486/i586-driven PCI-Board, except for the BIOS, but the hardware should be the very same.)

PCI allows cheaper production of onboard components, and needs no glue-logic chips.

2.2 Performance

taken from Craig Sutphin's Pro-PCI-Propaganda

> Unlike some local buses, which are aimed at speeding up graphics alone, the PCI Local Bus is a total system solution, providing increased performance for networks, disk drives, full-motion video, graphics and the full range of high-speed peripherals. At 33 MHz, the synchronous PCI

> Local Bus transfers 32 bits of data at up to 132 Mbytes/sec. A transparent 64-bit extension of the 32-bit data and address buses can double the bus bandwidth (264 Mbytes/sec) and offer forward and backwards compatibility for 32 and 64-bit PCI Local Bus peripherals. Because it is processor-independent, the PCI Local Bus is optimized for I/O functions, enabling the local bus to operate concurrent with the processor/memory subsystem. For users of high-end desktop PC's, PCI makes high reliability, high performance and ease of use more affordable than ever before; no trivial task at 33 MHz bus-clock rates. Variable length linear or toggle mode bursting for both reads and writes improves write dependent graphics performance. By comprehending the loading and frequency requirements of the local bus at the component level, buffers and glue logic are eliminated.

2.3 The onboard-SCSI-II-chip NCR53c810

One very nice feature of some PCI mother boards is the NCR onboard-SCSI-II-chip, which is said to be as fast as the EISA-Adaptec-1742, but much cheaper. Drivers for DOS/OS2 are available. Drew Eckard has released version 3 of his NCR53c810-driver. I run kernel 1.1.78 at the moment (9JAN94).

This works so well I sold my adaptec-1542B-ISA months ago. :-)

The NCR53c810-chip is onboard on some PCI-motherboards. There are add-on-boards available too, for about US$ 70.00.

The NCR-patches and bootimages are available on tsx-11.mit.edu:/pub/linux/ALPHA/scsi/ncr (approximately). Newer releases of Slackware 2.0 have support for the ncr too. Newer versions of the test-kernels (1.1.41 for example) do not require any patches; they have the driver already included.

There is only one thing I noticed does not work with the current NCR-drivers yet. Disconnect/Reconnect does not work, so using a SCSI-tape can be a pain especially when using "mt erase" or the like blocks the whole SCSI-bus until it has finished. This is very unsatisfying.

I personaly use the NCR-driver at the moment, but I am inclined to shell out some money on the new DPT-boards mentioned in this article. (Michael Will, 09JAN94.)

2.4 Drew Eckhardt on PCI-SCSI:

Drew said some time ago about the SCSI on PCI: (slightly edited for clarity in context)

> Currently, your only PCI SCSI option that stands a chance of working is the Buslogic 946. It purports to be Adaptec 1540 compatible, like the EISA/VESA/ISA boards in the series. I'm working on getting the Linux NCR53c810 driver stable, some one else is doing the same thing for one of the BSD flavors.
>
> This chip, offering fast busmastering, is included on motherboard implementations, and is (supposedly) available for US$ 100.00 on cards without BIOS (because many of the PCI boards that don't include the NCR chip onboard still do have the NCR BIOS).
>
> This covers the majority of PCI SCSI adapters on the market (Nexstor, Chaintech, Gigabyte, FIC, etc). Adaptec is shipping (see below) a FAST WIDE version of the AIC-7770 with a PCI

interface, and AIR is using it on their Pentium boards, but I haven't seen any separate board level product with it.

Scott Ferris is working on the AIC-7770 driver under Linux, but I don't know of anyone doing the same thing under one of the BSDs.

Emulux also has a propriety FAST+WIDE PCI controller. It's unlikely that it will show up as supported under one of the BSD's or Linux anytime soon, since the NCR based controllers are cheaper and more prevalent. Further, the NCR-equipped motherboards are often as cheap, or cheaper, than similar non-SCSI equipped boards.

The Buslogic PCI controllers are compatible with the 1540 (thus offering only that level of performance), so I doubt many Linux'ers will buy them.

Forex is shipping a PCI SCSI adapter, I don't have details.

Also note that since he said this, Drew has a working 810 driver out.

2.5 The EATA-DMA driver and the PCI SCSI controllers from DPT

The EATA-DMA scsi driver has undergone extensive changes and now also supports PCI SCSI controllers, multiple controllers and all SCSI channels on the multichannel SmartCache/Raid boards.

The driver supports all EATA-DMA Protocol (CAM document CAM/89-004 rev. 2.0c) compliant SCSI controllers and has been tested with many of those controllers in mixed combinations.

```
Those are:              (ISA)   (EISA) (PCI)
      DPT Smartcache: PM2011  PM2012A
                              PM2012B
      Smartcache III: PM2021  PM2022  PM2024
                              PM2122  PM2124
                              PM2322
      SmartRAID     : PM3021  PM3122  PM3224
                              PM3222
      and some controllers from NEC and ATT.
```

On a "base" DPT card (no caching or RAID module), a MC680x0 controls the bus-mastering DMA chip(s) and the SCSI controller chip. The DPT SCSI card almost works like a SCSI coprocessor.

The DPT card also will emulate an IDE controller/drive (ST506 interface), which enables you to use it with all operating systems even if they don't have an EATA driver.

On a card with the caching module, the 680x0 maintains and manages the on-board cacheing. The DPT card supports up to 64 MB RAM for disk-cacheing.

On a card with the RAID module, the 680x0 also performs the management of the RAID, doing the mirroring on RAID-1, doing the striping and ECC info generation on RAID-5, etc.

The entry level boards utilize a Motorola 68000, the high-end, more raid specific DPT cards use a 68020, 68030 or 68040/40MHz processor.

Official list prices range from $245 to 1995$ (December 1, 1994)

Since I've been asked numerous times where you can buy those boards in Europe, I asked DPT to send me a list of their official European distributors. Here is a small excerpt:

```
Austria: Macrotron GmbH            Tel:+43 1 408 15430   Fax:+43 1 408 1545
Denmark: Tallgrass Technologies A/S Tel:+45 86 14 7000   Fax:+45 86 14 7333
Finland: Computer 2000 Finnland OY Tel:+35 80 887 331    Fax:+35 80 887 333 43
France : Chip Technologies         Tel:+33 1 49 60 1011  Fax:+33 1 49 599350
Germany: Akro Datensysteme GmbH    Tel:+49 (0)89 3178701 Fax:+49 (0)89 31787299
Russia : Soft-tronik               Tel:+7 812 315 92 76  Fax:+7 812 311 01 08
U.K.   : Ambar Systems Ltd.        Tel:+44 296 435 511   Fax:+44 296 479 461
```

"IMHO, the DPT cards are the best-designed SCSI cards available for a PC. And I've written code for just about every type of SCSI card for the PC. (Although, in retrospect, I don't know why!) ;-)" Jon R. Taylor (jtaylor@magicnet.net) President, Visionix, Inc.

The latest version of the EATA-DMA driver and a Slackware bootdisk is available on: ftp.uni-mainz.de:/pub/Linux/Drivers/SCSI/EATA

Since patchlevel 1.1.81 the driver is included in the standard kernel distribution.

The author can be reached under these addresses: neuffer@goofy.zdv.uni-mainz.de or linux@uni-koblenz.de

2.6 Future Domain TMC-3260 PCI SCSI

Rik Faith (faith@cs.unc.edu) informed me on Wed, 1 Feb 1995 about the Future Domain TMC-3260 PCI SCSI card being supported by the Future Domain 16x0 SCSI driver. Newer information might be contained in the SCSI-HOWTO.

- Detection is not done well, and does not use standard PCI BIOS detection methods (someone who has a PCI board needs to send me patches to fix this problem). So, you might have to fiddle with the detection routine in the kernel to get it detected.
- The driver still does not support multiple outstanding commands, so your system will hang while your tape rewinds.
- The driver does not support the enhanced pseudo-32bit transfer mode supported by recent Future Domain chips, so you will not get transfer rates as high as under DOS.
- The driver only supports the SCSI-I protocol, so your really fast hard disks will not get used at the highest possible throughput. (Again, fixes for all these problems are solicited – no one is working on them at this time.)

2.7 other thoughts on scsi

James Soutter (J.K.Soutter1@lut.ac.uk) asked me to add the following information on Fast-Wide-SCSI-2:

> Fast Wide SCSI-2 is sometimes incorrectly called SCSI-3. It differs from the normal Fast SCSI-2 (like the Adapted 1542B?) because it uses a 16 bit data bus rather than the more usual 8 bit bus. This improves the maximum transfer rate from 10 MB/s to 20 MB/s but requires the use of special Fast Wide SCSI-2 drives. The added performance of Fast Wide SCSI-2 will not necessarily improve the speed of your system. Most hard disk drives have a maximum internal transfer rate of less than 10 MB/s and so one drive alone can not flood a FAST SCSI-2 bus.
>
> In Seagate's Oct 1993 product overview, only one Fast Wide SCSI-2 drive has an internal transfer rate of more than 10 MB/s (the ST12450W). Most of the drives have a maximum internal transfer rate of 6 MB/s or less, although the ST12450W is not the only exception to the rule. In conclusion, Fast Wide SCSI is designed for the file server market and will not necessarily benefit a single user workstation style system.
>
> Rather than buying a PCI system with a SCSI interface on the motherboard, or rather than waiting for the NCR driver, you could purchase a separate PCI based SCSI card. According to Drew, the only PCI SCSI option that stands a chance of working is the Buslogic 946. It purports to be Adaptec 1540 compatible, like the EISA/VESA/ISA boards in the series.
>
> Drew commented that other PCI based SCSI controllers are unlikely to be supported under Linux or the BSD's because the NCR based controllers are cheaper and more prevalent.

I personally would tend to try the NCR-Driver.

According to broom@ocean.fit.qut.edu.au (Bradley Broom):

> The Buslogic BT-946C PCI SCSI works if you disable the option "enable Disconnection" with the AUTOSCSI-program under DOS which comes with the card.

Ernst Kloecker (ernst@cs.tu-berlin.de) wrote: (edited)

> Talus Corporation has finished a NS/FIP driver for PCI boards with NCR SCSI. It will be shipping very soon, might even be free because a third party might pay for the work and donate the driver to NeXT.

Not every PCI-Board has got the chip. ASUS does, and one of the J-Bond boards does, too. Some vendors provide an alternative as you can read in Drew's text...

The NCR-Chip is clever enough to work with drives formatted by other controllers, and should be no problem.

3 ASUS-Board

Detailed information on the old ASUS PCI-I-SP3 from heinrich@zsv.gmd.de:

- 3 PCI, 4 ISA Slots (3x16, 1x8 Bit)
- ZIF Socket for the CPU
- room for 4 72pin-SIMMs (max. 128M)

- Award BIOS in Flash-Eprom
- Onboard: NCR-SCSI, 1par, 2ser (with FIFO), AT-Bus, Floppy

The board does like most in that price class – write-through cache, no write-back. This should not be significant, maybe 3% of performance.

The BIOS supports scsi-drives under DOS/Windows without additional drivers, but with the board come additional drivers which are said to give better performance, for DOS/Windows(ASPI), OS2, Windows-NT, SCO-Unix, Netware (3.11 and 4, if interpreted correctly)

Gert Doering (gert@greenie.muc.de) was saying the SCO-Unix-driver for the onboard-SCSI-Chip was not working properly. After two or three times doing: "time dd if=/dev/rhd20 of=/dev/null bs=100k count=500" it kernel-paniced...

The trouble some people experienced with this board might be due to them using an outboard Adaptec-SCSI-Controller with "sync negotiation" turned on. (This predates the NCR driver release; hence the use of the Adaptec.) Please check that in the BIOS-Setup of the Adaptec-1542C if you use one and have problems with occasional hangups!

There is a new version of the ASUS-Board which should have definitely less problems. It is called ASUS-PCI-I/SP3G, the G is important. It has the new Saturn-chipset rev. 4 and the bugs should be gone. They use the Saturn-ZX-variant and the new SP3G has fully PCI conforming level-triggered (thus shareable), BIOS-configurable interrupts. It has an on-board PS/2-mouseport, EPA-power-saving-modes and DX4-support, too. It performs excellently. If you can get the German computer magazine C't from July (?), you will find a test report where the ASUS-Board is the best around.

Latest information about ASUS-SP3-G: You might experience crashes when using PCI-to-Memory-Posting. If you disable this, all works perfect. jw@peanuts.informatik.uni-tuebingen.de said he believed it to be a problem of the current Linux-kernel rather than the hardware, because part of the system still works when crashing, looking like a deadlock in the swapper, and OS2/DOS/WINDOZE don't crash at all.

4 confusion about saturn chipsets

Pat Duffy (duffy@theory.chem.ubc.ca) said:

```
Saturn I:  these are revisions 1 and 2 of the Saturn chipsets.
Saturn II:  This is also called rev. 4 of the Saturn chipsets.

As far as I know, rev. 3 never actually shipped, and (from a few people who
have it) the SP3G now has rev. 4 (or Saturn II) in it.

Confused?  Well, the only real definitive answer is to get ahold of the board
and run the debug script in the PCI chipset list on it.  As far as I know,
though, the SP3G board is indeed shipping with rev. 4 (Saturn II).
```

5 Video-Cards

Linux people have successfully used # 9 XGE Level 12, ELSA Winner 1000, and S3928 video cards. The new XFree86(tm)-3.1 does support boards with the tseng et4000/w32 in accelerated mode now, as well as S3 Vision 864 and 964 chipsets including boards like the ELSA Winner 1000Pro and 2000Pro, Number Nine GXE64 and GXE64Pro, Miro Crystal 20SV). 16bpp mode (65K colors instead of the usual 256) support for Mach32 boards as well as 32bpp for some S3 boards and the P9000 boards has been added. see more details in the XFree86(tm)-3.1 announcements.

The Mach64 is only supported as dumb vga-card, no accelerated mode available at XFree86(tm)-3.1.

tldraben@eos.ncsu.edu reported:

- Diamond Stealth W32 – Text mode works, X11 suffered from "pixel dust"
- ET4000/W32 – unbearable (should be better by now)
- # 9GXEL13 – Works, virtual consoles corrupted when switched. Had to buy card from Dell.

Genoa Phantom 8900PCI card seems to work well. Genoa Phantom/W32 2MB does not work in an ASUS-Board. Tseng 3000/W32i chipset seems to work well. Spea-v7 mercury-lite works perfectly since XFree86-2.1.

ATI Graphics Ultra Pro for PCI with 2MB VRAM and an ATI68875C DAC run well as dem@skyline.dayton.oh.us tells us: "It's humming right along at 1280x1024 w/256 colors @74Hz non-interlaced. Looks great."

Paradise WD90C33 PCI did lock up on screensaver/X - this has been solved in the newer versions of the kernel. jbauer@badlands.NoDak.edu (John Edward Bauer)

miroChrystal 8S/PCI (1MB) S3 - no problem.

6 Ethernet Cards

Of course the ISA-ethernet-cards still work, but people are asking for PCI-based ones. The author of many (if not most) ethernet- drivers said the following:

> From: Donald Becker (becker@cesdis.gsfc.nasa.gov) Subject: PCI ethernet cards supported? The LANCE code has been extended to handle the PCI version. I hope to get the PCI probe code (about a dozen extra lines in the LANCE driver) into the next kernel version. I'm working on the 32 bit mode code. I haven't yet started the 21040 code.
>
> I'll write drivers for the PCnet32 mode and the DEC 21040. That will cover most of the PCI ethercard market.
>
> file://cesdis.gsfc.nasa.gov/pub/people/becker/whoiam.html

In the new testkernels of 1.1.50 and above, the AMD-singlechip ethernetadapters are supported. With a pentium, they ought to then see 900K/second ftps +(assuming an NCR PCI scsi controller) at about 20% cpu load. (AMD Lance).

Anything based on the AMD PCnet/PCI chip should work at the time being. In the US the Boca board costs under US$ 70

7 Motherboards

The people who answered were using the following boards:

7.1 ASUS

- Ruediger.Funck@Physik.TU-Muenchen.DE - successful.
- strauss@dagoba.escape.de - half-successful, works, but...
- ut@informatik.uni-kiel.d400.de - successful.
- heinrich@zsv.gmd.de - successful
- CARSTEN@AWORLD.aworld.de - successful
- egooch@mc.com - successful - but trouble with the serial port
- archie@CS.Berkeley.EDU and his friend - successful after solving IDE-puzzle
- Lars Heinemann (lars@uni-paderborn.de) successful
- Michael Will (michaelw@desaster.student.uni-tuebingen.de) - successful.

7.2 Micronics P54i-90

root@intellibase.gte.com succesful bill.foster@mccaw.com successful

7.3 SA486P AIO-II

ah@doc.ic.ac.uk successful

7.4 Sirius SPACE

hi86@rz.uni-karlsruhe.de - successful

7.5 Gateway-2000

kenf@clark.net - no problems except the soundcard he tries to swap dmarples@comms.eee.strathclyde.ac.uk - successful, but... robert logan (rl@de-montfort.ac.uk) - flawless. James D. Levine (jdl@netcom.com) - flawless.

7.6 Intel-Premiere

grif@cs.ucr.edu - successful jeromem@amiserv.xnet.com - successful demarest@rerf.or.jp - successful (Premier-II)

7.7 DELL Poweredge SP4100 gbelow@pmail.sams.ch - successful

7.8 Comtrade Best Buy PCI / PCI48X MB Rev 1.0

tldraben@eos.ncsu.edu - "Works, I believe it has buggy Saturn chipset"

7.9 IDeal PCI / PCI48X MB Rev 1.0

tldraben@eos.ncsu.edu - "Did not work with PCI48X motherboard"

7.10 CMD Tech. PCI IDE / CSA-6400C

tldraben@eos.ncsu.edu - "Works"

7.11 GA-486iS (Gigabyte)

Stefan.Dalibor@informatik.uni-erlangen.de - success with problems.

7.12 GA-586-ID (Gigabyte) 90 Mhz Pentium PCI/EISA Board

kkeyte@esoc.bitnet - succesful

7.13 ESCOM 486dx2/66 - which board?

Works perfect except the ftape-streamer (archive)

7.14 J-Bond with i486dx2/66

Drew Eckhardt (drew@kinglear.cs.Colorado.EDU) - The NCR53c810 doesn't work too hot (yet), but I'm working on fixing that.

8 reports on success

8.1 Micronics P54i-90 (root@intellibase.gte.com)

Pentium with 90Mhz, 32M RAM and 512K L2-cache. Works extremely well (a kernel recompile takes 10 minutes :-).

The board includes:

- UART - two 16550A high speed UARTS
- ECP - one enhanced parallel port
- Onboard IDE controller
- Onboard floppy controller

Pros: Currently, I'm using it with an Adaptec 1542CF and a 1G Seagate drive, No problems. Graphics is ATI Graphics Pro Turbo (PCI). Very fast. The serial ports can keep up with a TeleBit T3000 modem (38400) without overruns. Caching above 16M does occur. There are 3 banks of SIMM slots (2 SIMM's per bank), with each bank capable of 64M each (2 32M 72-pin SIMM's). Each bank must be filled completely to be used (I'm only using bank 0 with 2 16Mx72-pin SIMM's). The CPU socket is a ZIF type socket. The BIOS is Phoenix, FLASH type.

Drawbacks: RAM is expandable to 192M, but the L2 cache is maxed at 512K. While the graphics are very fast, there is currently no XF86 server for the Mach64 (well, actually there is, but it doesn't use any of the accelerator features; it's just an SVGA server). I don't know if the onboard IDE hard drive controller works; I'm prejudiced against a standard that won't allow my peripherals to operate across platforms, so I didn't buy an IDE disk; instead, I got a Seagate 31200N and a NEC 3Xi.

Mitch

8.2 Angelo Haritsis (ah@doc.ic.ac.uk) about SA486P AIO-II:

The motherboard I eventually bought (in the UK) is one supporting 486 SX/DX/DX2/DX4 chips. It is called SA486P AIO-II. Features include:

- Intel Saturn v2 chipset
- Phoenix BIOS (flash eprom option)
- NCR scsi BIOS v 3.04.00
- 256K 15ns cache (max 512) write back and write through
- 4 72-pin SIMM slots in 2 banks
- 3 PCI slots, 4 ISA
- On-board NCR 53c810 scsi controller

- On-board IDE / floppy / 2 x 16550A uarts / enhanced parallel

I bought it from a company (UK) called ICS, (note I have no connections whatsoever with the company, just a happy customer). I use a 486/DX2-66 CPU.

Before I had a VLB 486 m/board with a buslogic BT-445S controller that I was borrowing. I have 2 scsi devices: 1 barracuda 2.1GB ST12550N disk and a Wangtek 5525ES tape drive. I was expecting a lot of adventures by switching to the new motherboard, esp after hearing all these non-success stories on the net. To my surprise everything worked flawlessly on the 1st boot! (1.1.50). And it has been doing so for about a month now. I did not even have to repartition the disk: apparently the disk geometry bios translation of the 2 controllers is the same. Linux has had no problems at all. SCSI is visibly much faster as well (sorry, I have no actual performance measurements).

The only problems (related to Drew's linux ncr53c7,810 scsi driver - thanks for the good work Drew!) are:

- no synchronous transfers are yet supported =¿ performance hit
- disconnect/reconnect is disabled =¿ disk scsi ops "hold" during certain slow scsi device opeartions (eg tape rewind)
- tagged queuing is not there (?) =¿ performance hit

There has been no progress on the ncr driver since Sept 94. (current writing: 19 Jan 95).

If you get Windows complaiing about 32-bit disk driver problems, just disable 32-bit disk access via Control Panel. This should not hurt performance. (What I did is remove the WDCTRL driver from my SYSTEM.INI).

All else is fine. I tried the serial ports with some dos/windows s/w and worked ok. The IDE/floppy work ok as well. I have not tried the parallel yet. The motherboard is quite fast and so far I am very pleased with the upgrade. I have not yet tried a PCI graphics board. I will later on. I am using an old ISA S3 which is fine at the moment.

8.3 bill.foster@mccaw.com about his Micronics M5Pi

Micronics M5Pi motherboard with 60 MHz Pentium, PCI bus having the following components:

```
16Mb RAM/512k cache
onboard IDE, parallel, 16550A UARTS
2 X 340MB Maxtor IDE Hard Drives
Soundblaster 16 SCSI-II
Toshiba 3401B SCSI CD-ROM
Archive Viper 525MB SCSI Tape Drive
Viewsonic 17 monitor
Cardex Challenger PCI video card (ET4000/W32P)
A4-Tech Serial Mouse
```

Everything works great, Slackware installation was very easy, I can run Quicken 7 for DOS under DOSEMU. I run X at 1152x900 resolution at 67Hz.

8.4 Goerg von Below (gbelow@pmail.sams.ch) about DELL Poweredge

```
- Intel 486DX4/100
- 16 MB RAM
- DELL SCSI array (DSA) with Firmware A07, DSA-Manager 1.7
- 1 GB SCSI HD DIGITAL
- NEC SCSI CD-ROM
- 2 GB internal SCSI streamer
- 3-Com C579 EISA Ethernet card
- ATI 6800AX PCI VGA subsystem, 1024 MB RAM

CAVE! DELL SCSI Array controller (DSA) runs only with firmware Rev. A07 !
A06 is buggy, impossible to reboot !
To get it: ftp dell.com , file is /dellbbs/dsa/dsaman17.zip
```

Apart from this firmware-problem there where no problems for the last 2 months, running with linux 1.1.42 as primary nameserver, newsserver and www-server on internet.

8.5 zenon@resonex.com about Gateway2000 P-66

Gateway2000's P5-66 system with Intel's PCI motherboard, with 5 ISA slots and 3 PCI slots. The only PCI card I am using is the # 9 GXe level 12 PCI card (2 MB VRAM and 1 MB DRAM). This card was bought from Dell. Under Linux I am using the graphics in the 80x25 mode only (I am waiting for some XFree86 refinements before using it in 1280x1024 resolution), but under DOS/Windows I have used the card in 1280x1024x256 mode without problems. Etherlink 3C509 Ethernet card, Mitsumi bus-interface card, Adaptec 1542C SCSI interface card and additional serial/parallel ports card (which makes the total of serial ports 3).

I have total of 32 MB RAM (recognized and used by both Linux and DOS). There is also a bus mouse (Microsoft in the PS2 mode).

No problems so far.

8.6 James D. Levine (jdl@netcom.com) with Gateway2000

Gateway 2000 P5-60 with an Intel Mercury motherboard, AMI-Flash-BIOS, (1.00.03.AF1, (c)'92) 16M RAM, on-board IDE controller and an ATI AX0 (Mach32 Ultra XLR) PCI display adapter. He had absolutely no problems with the hardware so far but has not tried anything fancy, such as accelerated IDE drivers or SCSI support.

8.7 hi86@rz.uni-karlsruhe.de with SPACE

SPACE-board, 8MB RAM, S3 805 1MB DRAM PCI 260MB Seagate IDE-hard disk because of lack of NCR53c810-Driver, 0.99pl15d, does seem to work well.

8.8 grif@cs.ucr.edu with INTEL

17 machines running a 60Mhz-i586 on Intel-Premier-PCI-Board

8.9 Jermoe Meyers (jeromem@amiserv.xnet.com) with Intel Premiere

Motherboard - Intel Premiere Plato-babyAT 90mhz with Buslogic bt946c w/4.86 mcode w/4.22 autoSCSI firmware, (note, mine came with 4.80 mcode and 4.17 autoSCSI firmware. (interrupt pins A,B,C conform to respective PCI slots!) ATI Xpression (Mach64) - using driver from sunsite, (running AcerView 56L monitor).

The motherboard has 4 IDE drives, Linux (Slackware 2.0) sees the first two and everything on the Buslogic as it emulates an adaptec 1542. Uh, yes, Dos sees them all. Buslogic is VERY accomodating in regards to shipping upgraded chips (you will have to know how to change PLCC (plastic leaded chip carrier) chips, 3 of them. Though, don't let that scare you :-) it's not that tough. Get a low end PLCC removal tool, and your in business. You also might want to "flash upgrade your system bios from Intel's IPAN BBS, a trivial process. Whats even more interesting is I also have a Sound Blaster SCSI-2 running a scsi CDROM drive off it's adaptech 1522 onboard controller. So thats 4 IDE drives (2 under Linux) and 2 SCSI-2 controllers.

I hope this helps others who are struggling with PCI technology use Linux! Jerry (jeromem@xnet.com)

8.10 heinrich@zsv.gmd.de with ASUS

ASUS-PCI-Board (SP3) having:

- – Asus PCI-Board with AMD 486/dx2-66 and 16M RAM
- – Fujitsu 2196ESA 1G SCSI-II
- – Future Domain 850MEX Controller (cheap-SCSI-Controller, almost a clone to Seagate's ST01... want's to use ncr53c810 as soon as the driver comes out
- – ATI Graphics Ultra (the older one with Mach-8 Chip, ISA-Bus)
- – Slackware 1.1.1

He just exchanged the boards, plugged his cards in, connected the cables, and it worked perfect. He does not use any PCI-Cards yet, though.

8.11 CARSTEN@AWORLD.aworld.de with ASUS

ASUS-PCI-Board with 486DX66/2, miro-crystal 8s PCI driven by the S3-drivers of XFree86-2.0, using the onboard SCSI-Chip. No problems with compatibility at all.

8.12 Lars Heinemann (lars@uni-paderborn.de) with ASUS

ASUS PCI/I-486SP3 Motherboard w/ 486DX2/66 and 16M RAM (2x8), miroChrystal 8S/PCI (1MB) S3, Soundblaster PRO, Adaptec 1542b (3.20 ROM) SCSI host adapter with two hard disks (Fujitsu M2694ESA u. Quantum LPS52) and a QIC-150 Streamer attached. No problems at all!

8.13 Ruediger.Funck@Physik.TU-Muenchen.DE with ASUS

ASUS PCI/I-486SP3 / i486DX2-66 / 8 MB PS/2 70 ns BIOS: Award v 4.50 CPU TO DRAM write buffer: enabled CPU TO PCI write buffer: enabled PCI TO DRAM write buffer: disabled, unchangeable CPU TO PCI burst write: enabled Miro Crystal 8s PCI - S3 P86C805 - 1MB DRAM

Quantum LPS 540S SCSI-Harddisk on NCR53c810-controller.

8.14 robert logan (rl@de-montfort.ac.uk with GW/2000)

Gateway 2000 4DX2-66P 16 Megs RAM, PCI ATI AX0 2MB DRAM (ATI GUP). WD 2540 Hard Disk (528 Megs) CrystalScan 1776LE 17inch. (Runs up to 1280x1024) Slackware 1.1.2 (0.99pl15f)

It is giving no problems. He uses SLIP for networking and an Orchid-Soundwave-32 for niceties, awaiting the NCR-Driver. The only problem he has is that the IDE-Drive could be much faster on the PCI-IDE. It is one of the new Western Digital fast drives and in DOS/WfW it absolutely screams - on Linux it is just as slow as a good IDE-Drive.

8.15 archie@CS.Berkeley.EDU and his friend use ASUS

Archie and his friend have rather similar configurations:

- ASUS PCI-SP3 board (4 ISA, 3 PCI)
- Intel 486DX2/66
- Genoa Phantom 8900PCI card (friend: Tseng 3000/W32i chipset)
- Maxtor 345 MB IDE hard drive
- Supra 14.4 internal modem
- ViewSonic 6e monitor (Archie)
- NEC Multisync 4fge (friend)
- Slackware 1.2.0

The onboard-SCSI is disabled. First there were problems with the IDE-drive: “on the board there’s a jumper which selects whether IRQ14 comes from the ISA bus or the PCI bus. The manual has an example where they show connecting it to PCI INT-A. Well, we did that just like the example... but then later our IDE drive

would not work (the IDE controller is on board). Had to take it back. The guys at NCA were puzzled, then traced it back to this jumper. I guess the IDE controller uses IRQ14 or something? That's not documented anywhere in the manual. Other than that, seems to be kicking ass nicely now. Running X, modeming, etc. (for the Supra you have to explicitly tell the kernel that the COM port has a 16550A using setserial (in Slackware /etc/rc.d/rc.serial))".

8.16 Michael Will with ASUS-SP3 486 (the old one)

uses the following:

- ASUS PCI-SP3-Board with 486dx2/66 and 16M RAM
- NCR53c810-SCSI-II chip driving a 1GB-Seagate-SCSI-II disk and a Wangtec-tape
- ATI-GUP PCI Mach32 Graphics card with 2M VRAM running perfectly with XFree86(tm)-3.1 8bpp and 16bpp
- Linux kernel 1.1.69

It runs perfectly and I am content with the speed, the ATI-GUP-PCI (Mach32) does not give as good benchmarks as expected, though. If I had the money I'd get me an Intel Premiere-II (Plato chipset) with P90 and number-9 GXE64Pro... I keep on dreaming :-)

8.17 Karl Keyte (kkeyte@esoc.bitnet) Gigabyte GA586 Pentium

- PCI/EISA Board Gigabyte GA586-ID 90MHz Pentium (dual processor, one fitted)
- 32M RAM
- SCSI - no scsi-NCR-chip on-board, using Adaptec 1542C,
- PCI ATI GUP 2M VRAM
- Adaptec 1742 EISA SCSI controller
- Soundblaster 16
- usual I/O

Everything under DOS AND Linux works perfectly. No problem whatsoever. A VERY fast machine! BYTE Unix benchmarks place it about the same as a Sun SuperSPARC-20 running Solaris 2.3. The PC is faster for integer arithmetic and process stuff (including context switching). The SPARC is faster for floating point and one of the disk benchmarks.

8.18 kenf@clark.net with G/W 2000

He uses a Gateway 2000 with no problems, except the soundcard (which one?). He is trading it in for a genuine soundblaster in hopes that will help.

8.19 Joerg Wedeck (jw@peanuts.informatik.uni-tuebingen.de) / ESCOM

originaly buyed a 486 DX2/66 from ESCOM (which board?) with onboard IDE and without (!) onboard NCR-SCSI-chip. ISA-adaptec 1542cf scsi-controller instead spea v7 mercury lite (s3, PCI, 1MB), ISA-Soundblaster-16, mitsumi-cdrom (the slower one). Everything except the archive-streamer works with no problems. The spea-v7 works perfectly since XFree86-2.1

He abandoned the Intel-board in favour of an ASUS-SP3-g and has some problems with PCI-to-Memory burstmode which is crashing only on Linux, "looking like a deadlock in the swapper". If you have any information on this, please eMail the maintainer of the PCI-HOWTO.

After turning off the PCI-to-Memory posting feature it just works perfect.

Rather than sending him mail please read his http-homepage at "http://wsiserv.informatik.uni-tuebingen.de/ jw" where he keeps information about his PCI-system, too.

8.20 ut@informatik.uni-kiel.d400.de / ASUS

ASUS-PCI board with AMD486dx40 (but actually running at 33Mhz?!) His ISA-ET3000 Optima 1024A ISA works nice.

9 Reports of problems

9.1 hschmal@informatik.uni-rostock.de and SCSI-PCI-SC200

He reports that after plugging that card into his Pentium-board, Linux no longer boots. My first guess is that it is not supported.

9.2 dmarples@comms.eee.strathclyde.ac.uk G/W 2000

Gateway 2000 G/W 2000 4DX2/66 PCI ATI-Graphics-Ultra-Pro IDE of indeterminate make

It works well - only the IDE-Card runs in ISA-compatibility-mode, and works a lot faster when switched into PCI-Mode by a DOS-program... thus it's not that fast in Linux, and a patch would be nice.

9.3 cip574@wpax01.physik.uni-wuerzburg.de (Frank Hofmann) / ASUS

He uses the ASUS-board with 16MB-RAM, ISA-based S3/928, and the onboard-IDE-controller with a Seagate ST4550A harddisk. He's had no trouble with the newer Linux-kernels.

His problem:

> using X, my mouse is not responding the way I was used to before. It's sometimes behind movement and makes jumps if moved quickly. I think this was discussed In a Linux

```
newsgroup before (I don't know which one) and is due to the use of 16550 serial chips
for the onboard serial interfaces.  After two weeks, I got used to it :-)
```

Reducing the threshold of the 16550 should help. There should be a patch to setserial available somewhere, but I do not know where.

9.4 axel@avalanche.cs.tu-berlin.de (Axel Mahler) / ASUS

ASUS PCI/I-486SP3 Motherboard (Award BIOS 4.50), 16 MB RAM the on-Board NCR Chip is disabled, he had the Genoa Phantom/W32 2MB for PCI and a Adaptec AHA-1542CF (BIOS v2.01) connected to:

- an IBM 1.05 GB Harddisk
- a Toshiba CD-ROM (XM4101-B)
- a HP DAT-Streamer (2GB)

when creating the filesystems, 'mke2fs' (0.4, v. 1.11.93) hung and installation was impossible. After replacing the Genoa Phantom/W32 2MB PCI with an ELSA Winner 1000 2MB PCI it worked perfectly. He tested it with an old Eizo VGA-ISA and it worked as well, so the problem was in the Genoa-PCI-card.

9.5 Frank Strauss (strauss@dagoba.escape.de) / ASUS

ASUS SP3 Board i486DX2/66 NCR53c810 disabled Adaptec 1542B in ISA Slot with 2 hard drives (200MB Maxtor, 420MB Fijutsu), SyQuest 88MB and Tandberg Streamer ELSA Winner 1000 PCI, 1MB-VRAM Soundblaster Pro in ISA Slot at IRQ 5 Onboard IDE disabled Onboard serial, parallel, FD enabled

After a reset, the machine sometimes 'hangs' (soft and hard-reset the same) - this is probably not related to the Adaptec and the Soundcard, because even without these the system sometimes fails to come up. But if it runs, (and the ELSA-WINNER-1000-PCI-message appears) it runs ok.

The two serial ports are detected as 16550 as they should, but at some mailbox-sessions there was heavy data-loss at V42bis... The problem seems to be in the hardware...

CPU>-PCI-Burst seems to work well with DOS/MS-Windows

CPU->PCI-Burst does not work properly with linux0.99p15, Messing up when switching the virtual-consoles, crashing completely when calling big apps like ghostview, or xdvi, leaving the SCSI-LED on (!).

(I suspect these apps would be using a lot of CPU->PCI-burst because of the big heap of data to transmit to the PCI-Winner-1000)

After disabling CPU->PCI-Burst, it works well, the Winner-1000 at 1152x846 (not much font cache with 1MB) does 93k xstones. OpaqueMove with twm is more than just endureable :-)

He has got a SATURN.EXE which he loads under DOS before starting Linux, helping to turn on burst without hangs...

Someone stated that these problems might go away when turning off "sync negotiation" on the Adaptec - I do not know if this is possible with the adaptec1542B too? But I guess so.

With CPU->PCI-Burst it yielded 95k xstones, so he considers it as not too grave to do without. His only problem is that he would like to run his Winner-1000 at 1152x900 which fails because it seems to take any x-resolution higher than 1024pixels as a 1280pixel-resolution, thus wasting a lot end resulting in a y-resolution of 816pixels... but this is probably no PCI-related problem. It should have gone away with XFree86-2.1

9.6 egooch@mc.com / ASUS

- BOARD ASUS PCI/I-486 SP3 RAM: 16MB (4x4M-SIMM)
- CPU 486DX33 CPU
- BIOS Ver. 4.50 (12/30/93)
- Floppy Two floppy drives (1.2 and 1.44), using ASUS on-board floppy controller
- SCSI tried both WD7000 SCSI controller and Adaptec 1542CF and worked.
- Two SCSI 320M hard drives
- SCSI NEC84 CDROM drive
- SCSI QIC150 Archive tape drive
- Video - Tseng ET4000 ISA graphics card
- Sound PAS16 sound card
- Printer attached to on-board ASUS parallel port

He has nothing in the PCI-Slots yet, but wants to buy a PCI-Video-Card, currently uses WD7000 SCSI controller but will switch to the NCR-Chip onboard as soon as the driver is out.

Everything works perfectly - the first serial port which has a 14.4K-Modem attached does hang occasionally when reconnecting with the modem after having used it previously. He says that would not be unique to ASUS but rather a bug in the SMC-LSI device with its 16550UART. The logitech-serial-mouse on the second port works fine. Setting down the threshold of the 16550 for the mouseport would definitely help, one does seem to need a special patched setserial for that? I have not got the information yet, please contact me if you know more!

9.7 Stefan.Dalibor@informatik.uni-erlangen.de / GigaByte

- Board - GA-486iS from Gigabyte w/ 256Kb 2L-Cache, i486-DX2
- Bios - AMI, 93/8
- SCSI - no scsi-NCR-chip on-board, using Adaptec 1542C,
- Video - ELSA Winner 1000
- Linux 0.99pl14 + SCSI-Clustering-Patches / Slackware 1.1.1

All seems to go well, but he has not tried neither networking, printing or a streamer yet. Before applying the clustering- patches he had some problems with hangs triggered by "find", but this no longer is the case - perhaps it was an older kernel-bug.

The ELSA-Winner-1000 sometimes hangs, with very strange patterns on the screen resolved only by rebooting... The dealer has told him it was a bug in the ELSA-Card, but the manufacturer claims it had solved the problem. The bug is not reproducible so he does not plan to take any action at the moment.

All in all the machine seems to work very well under heavy text processing (emacs, LaTeX, xfig, ghostview) usage. Interaction is surprisingly responsive, little difference between it and the 3-4X as expensive Sun he works on...

CPU->PCI-Burst is still disabled because the bios does not support the PCI-things well?

A problem with his new modem (v32 terbo) arose: it looses characters. Especially when using SLIP it complains a lot about RX and TX errors. As soon as he runs X it gets unusable. He said he activated FIFO and RTS/CTS with stty, but to no avail...

9.8 Tom Drabenstott (tldraben@eos.ncsu.edu) with Comtrade / PCI48IX

PCI48IX Motherboard Rev. 1.0. Made by ??? documentation copyrighted by "exrc". The BIOS says not very much about PCI.

His E-315E Super IDE UMC (863+865) ISA-Controller-card does have problems. (It is a multifunction controller-card). It seems to work well under DOS/OS2 but not under Linux.

10 General tips for PCI-Motherboard + Linux NCR PCI SCSI

This was compiled by Angelo Haritsis (ah@doc.ic.ac.uk) from various people's postings:

10.1 DON'Ts:

Do *NOT* go for combination VLB/PCI motherboards. They usually have a lot of problems. Get a plain PCI version (with ISA slots as well of course). A lot of bad things have been heard about OPTI chipset PCI motherboards. Someone hints: "Avoid the OPTi (82C596/82C597/82C822) chipset based motherboards like the TMC PCI54PV".

(I know of at least one person having no problems with his TMC PCI54PV motherboard. He just had to put the NCR53c810 addonboard into slot-A which is the only slot capable of busmastering as it seems.)

Rumours say that Intel chipset PCI motherboards will have problems with more than one bus-mastering PCI board. I have not tried this one yet on mine and have nothing to suggest. I also heard that the Saturn II chipset is problematic, but this is the one I use and it is perfectly ok! Advice: Try to negotiate a 1-2 week money back agreement with your supplier, in case the motherboard you get has problems with the use you plan for it.

10.2 SIMM slots

Go for 72-pin only SIMMs for speed: Some (all?) of the mainboards which take 30 pin SIMMs use a 32 bit main memory interface, and will be significantly slower than the Intel based boards which all use a 64 bit or permantly interleaved memory interface. You might want to keep that in mind.

10.3 Praised PCI Pentium motherboard

The P90 Intel motherboard with the Intel Premiere II chipset (aka Plato). Get the latest BIOS which has concatenated NCR scsi BIOS 3.04.00. Otherwise DOS won't see your scsi disk(s) if you use a BIOS-less 53c810 based controller. NCR SCSI BIOS exists in the AMI BIOS of the plato after version 1.00.08 (or maybe verion 1.00.06). This BIOS is FLASH upgradeable so you should be able to get the upgrade on a floppy from your supplier. The current version is 1.00.10 and has all early problems fixed.

(Bios files should be available at ftp.demon.co.uk:/pub/ibmpc/intel, but I did not check that myself. the Autor.)

10.4 irq-lines

The value in the interrupt line PCI configuration register is usually set manually (for compatability with legacy ISA boards) in the extended CMOS setup screens on a per-slot or per-device basis. Older PCI mainboards also force you to set jumpers for each PCI slot/device which select how PCI INTA and perhaps INTB, INTC, and INTD are mapped to an 8259 IRQ line, Obviously, if these jumpers exist on your board, they must match the settings in the extended CMOS setup. Also note that some boards (notably Viglens) have silkscreens and instruction manuals which disagree with the wiring, and some experimentation may be in order.

10.5 Info about the different NCR 8xx family scsi chips:

All NCR 8XX Chips are dircet connect PCI bus mastering devices, that have no preformance difference wether on motherboard or add in option card. All devices comply with PCI 2.0 Specification, and can burst 32 bit data at the full 33 MHz (133Mbytes/Sec)

10.5.1 53C810

53C810 = 8 bit Fast SCSI-2 (10 MB/Sec) Single ended only Requires Integrated Mother board BIOS 100 pin Quad Flat Pack (PQFP) Worlds first PCI SCSI Chip, Volumes make it the most inexpensive.

10.5.2 53C815

53C815 = 8 bit Fast SCSI-2 (10 MB/Sec) Single Ended only Support ROM BIOS interface, which makes it ideal for add-in card Designs. 128 Pin QFP

10.5.3 53C825

53C825 = 8 bit Fast SCSI-2, Single ended or Differential 16 bit Fast SCSI-2 (20 MB/Sec), Single ended or Differetial Also has support for external Rom, making it a good candidate for add in cards. 160 pin QFP Not supported by linux yet. (See section below on news about the 825). Must have devices with wide or differential scsi to use these features.

10.6 future of 53c8xx

There are 4 new devices planned for announcement late this year and into early next year. Footprint compitible with 810 and 825 with some new features.

All the Chips require a BIOS in DOS/Intel applications. The 810 is the only chip that needs it resident on the motherboard. Latest NCR SCSI BIOS version: 3.04.00 The bios supports disks >1GB for DOS.

10.7 Performance of the 53c810

C't magazine's DOS benchmarks showed that it was significantly faster than the Buslogic BT-946, one user noted a 10-15% performance increase versus an Adaptec 2940, and with a very fast disk it may be 2.5X as fast as an Adaptec 1540.

11 news about NCR53c825 support

Drew Eckhardt stated this would indeed work with the driver included into the newer Linux Kernels, but there would be two trivial changes necessary:

```
Yes, although you have to remove the 3 from inside the brackets
for the pci_chip_ids[] array, and add an 825: to an obvious case
statement.
```

12 Conclusion

If I had the money I'd get me a P90 Pentium, using the Intel Premiere-II (aka Plato) motherboard, and the number-nine GXE64Pro. Since I don't have that much money I'd opt for a 486 on the new ASUS-486-PCI-SP3-G Board with the saturn-chipset rev. 4. and the PCI-ATI-GUP Mach32 with 2M VRAM. I can use x-window in 16bpp or 8bpp (64K colors or 256 colors) in accelerated mode that way. Since the mach64 is not supported yet I would not recommend buying it for the time being. The current linux-kernels seem to have some problems with this ASUS-486-PCI-SP3-g board with PCI-to-Memory-posting enabled, but the system is still very fast when disabling that feature. If you come across a 486-board which works with all PCI-features enabled, please let me know.

Another fine card since XFree86(tm)-3.1 is the fast and cheap et4000/w32-PCI-card.

So whatever mainboard you buy, you should get one with the NCR53c810-SCSI-chip on board. It is unbeatable in its price/speed.

13 Thanks

I want to thank the following people for supporting this document:

- David Lesher (wb8foz@netcom.com) for extensive help with the english language
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- Drew Eckhardt (drew@kinglear.cs.Colorado.EDU) for SCSI-informations

and many more peole adding information mostly by mail and by posts, some of them will be named here:

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If you sell this HOWTO on a CD or in a book I would like to have a copy for reference.

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