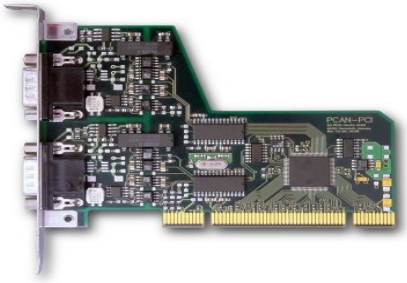

PCAN-driver for Linux

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table of documents

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Features of the 'pcan.o' or 'pcan.ko' driver

The „pcan.o“ or „pcan.ko“ driver is supporting PCAN-PCI, PCAN-ISA, PCAN-PC/104, PCAN-Dongle, PCAN-PCCARD as well as PCAN-USB hardware. Depending on the type of hardware (PCI, ISA, Dongle, PC Card, USB) 8 channels for each type can be supported. For PCAN-ISA, PCAN-PC/104 and PCAN-Dongle the base address and the used interrupt are settable. If no parameters are provided the driver uses factory defaults. A user program can communicate with the driver in three different ways:

1. ASCII formatted data can be provided or accepted over a „read()“ or „write()“ interface. This data contains information from received or transmitted telegrams or about channel initializing parameters.
2. With a „ioctl()“ interface. Through this interface user programs are able to receive and to transmit CAN-telegrams as well. However it is possible to get information about the channel status and to initialize the CAN-channel.
3. As a network device with commonly used network socket calls. This kind of interface is alternative to the previous kinds. It is called the netdev drivers interface, in contrast to the chardev drivers interface. To use the netdev drivers interface you have to install the Socket-CAN support from socketcan.berlios.de .

Most of this manuals content covers the usage of the chardev driver, see chapter “**Special features of the chardev driver**”. The netdev driver usage and installation is considered in depth in the chapter “**Special features of the netdev driver**”. Parts of the following chapters are different for chardev or netdev implementations. Exceptions are marked to pinpoint the difference.

Since version 5.0 of the driver support for the XENOMAI realtime add-on to the Linux kernel is available. You can get more information in the chapter “Realtime support with Xenomai”.

Special features of the “chardev driver”

The driver can be used from more than one user program at the same time and the simultaneous use of lots of interfaces and/or CAN channels is supported.

The reading or writing of telegrams can block if the receive buffer doesn't contain data

any more or if the write buffer is full. This behaviour can be disabled by opening the path as non-blocking.

If more than one user program communicates with the same CAN-channel the input or output is shared. (e.g.: Many user programs are accidentally sharing the received telegrams.)

The „select“-method is supported.

The interface to the driver (constants and structures) is defined in the header file „pcan.h“.

Special features of the “netdev driver”

The netdev driver interfaces to the kernels network modules via a so called Socket-CAN framework. Socket-CAN aims to be a standard interface for access of CAN devices. This kind of interface enhances the features compared to the chardev driver. Especially it provides:

- Possibility for multiple paths reading/writing from/to the same CAN channel
- Built-in filter capabilities, e.g CAN-ID (range) filters with can-raw sockets
- Built-in broadcast manager for cyclic sending of CAN telegrams and content filtering in the CAN-data, e.g. updates to userspace only on data change
- Simple user API accessible from mostly all programming languages since normal network socket calls are used (creating PF_CAN analogue to PF_INET)
- Local loopback of sent CAN frames for network transparent applications
- Socket-CAN is accompanied from lots of useful tools and utilities

The interface to the driver (constants and structures) is defined in the header file “can.h” and "error.h" as long as Socket-CAN is not part of the mainstream Linux kernel.

Preluding notes

Note: Before installing the software the hardware has to be installed in or at the computer (Exception: PCAN-Dongle, PCAN-PC Card or PCAN-USB, see at (6*)).

This manual is describing the installation process on a x86-Linux-computer with installed kernel 2.6.x. and a SuSE 10.1 system. Exceptions for kernel 2.4.x. and x86-RedHat systems are particularly mentioned.

Since driver version 6.0 support for kernels 2.2.x has ceased. If you need a driver for this kernels please have a look at the latest 5.x driver version.

During the installation sometimes a console and perhaps an editor as well will be used in the „root“- mode. If you want to login as „root“ user within a console or xterm-session you can use the 'su' command or the built in menu „file/root console“.

To start an editor in the „root“ – mode, just invoke from the menu „system/terminals/terminal (system manager mode)“ in KDE. From the console command line you might invoke the editor „kwrite“, „kate“ or „emacs“.

For some distributions the standard path doesn't include the „/sbin“ folder. Then installation commands have to typed in with „/sbin/“ ahead.

Examples:

```
/sbin/modprobe ...    instead of modprobe ...
/sbin/insmod ...      instead of insmod ...
/sbin/rmmod ...       instead of rmmod ...
/sbin/modinfo ...     instead of modinfo ...
```

Manual installation

Manual file unpacking

Unpack the file „peak-linux-driver.x.y.tar.gz“ into an optional folder into your home directory. Example:

```
tar  -xzf peak-linux-driver.x.y.tar.gz
```

Within this directory you get following tree of files:

```
peak-linux-driver-x.y/
|-- Documentation                    Any documentary
|   |-- COPYING                      GNU Public License
|   |-- Installation-en.pdf          This installation instructions
|   |-- template.c
|   |-- template.h
|   |-- template.make
|   `-- todo.txt
|-- Makefile                         A ‘global’ makefile
|-- driver                           The  driver and its sources
|   |-- Makefile                     The makefile for the driver
|   |-- pcan.h                       Application interface definitions of the driver
|   |-- pcan_make_devices            A script for generating device nodes
|   |-- src                          The driver sources
|   |   |-- can.h
|   |   |-- error.h
|   |   |-- pcan_common.h
|   |   |-- pcan_dongle.c
|   |   |-- pcan_dongle.h
|   |   |-- pcan_fifo.c
|   |   |-- pcan_fifo.h
|   |   |-- pcan_filter.c
|   |   |-- pcan_filter.h
|   |   |-- pcan_fops.c
|   |   |-- pcan_fops.h
|   |   |-- pcan_isa.c
|   |   |-- pcan_isa.h
|   |   |-- pcan_main.c
|   |   |-- pcan_main.h
|   |   |-- pcan_netdev.c
|   |   |-- pcan_netdev.h
|   |   |-- pcan_parse.c
|   |   |-- pcan_parse.h
|   |   |-- pcan_pccard.c
|   |   |-- pcan_pccard.h
|   |   |-- pcan_pccard-2.6.16.c
|   |   |-- pcan_pccard-2.6.17.c
|   |   |-- pcan_pccard-kernel.c
|   |   |-- pcan_pccard-kernel.h
|   |   |-- pcan_pci.c
|   |   |-- pcan_pci.h
|   |   |-- pcan_sja1000.c
|   |   |-- pcan_sja1000.h
|   |   |-- pcan_usb.c
|   |   |-- pcan_usb.h
|   |   |-- pcan_usb_kernel.c
|   |   `-- pcan_usb_kernel.h
|   |-- test.txt
|   `-- wstress
|-- lib                              The access library for (chardev)
|   |-- Makefile                     The makefile of the library (chardev)
|   |-- libpcan.h                    The library call prototypes (chardev)
|   `-- src                          The sources of the library (chardev)
|       `-- libpcan.c
`-- test                             The test programs
|-- Makefile                         The makefile to the test programs
|-- src                              The sources to the test programs
|   |-- bitratetest.c                To test bitrate calculations (chardev)
|   |-- common.c
|   |-- common.h
|   |-- filtertest.cpp               To test filter settings (chardev)
```

```
|   |-- parser.cpp
|   |-- parser.h
|   |-- receivetest.c              To receive test (chardev)
|   `-- transmitest.cpp            To transmit test (chardev)
`-- transmit.txt                   Test transmit instructions
```

Prerequisites for compilation of the sources

Before compiling following prerequisites have to be considered:

1. Up from kernel version 2.6.x the completely configured kernel sources for your target system have to be installed. If it is a standard installation the sources are located under „/usr/src/linux“ in which this normally is a link e.g. to „/usr/src/linux-2.6.6“. For every kernel smaller or equal than 2.4.x only the „kernel-headers“ have to be installed. (It's not wrong to install the complete sources of the target system.) The kernel-headers are installed if the invocation of “cat /lib/modules/'uname -r'/build/include/linux/modversions.h“ is ending without an error. (“'uname -r'“ is a place holder for the result of the invocation “uname -r“.)
2. The “/lib/modules/'uname -r'/build/include/linux/version.h“ file has to exist or being copied before from the path “/boot/vmlinuz.version.h“.
3. Tools like make, gcc, etc. have to be installed.
4. Your target kernel must have the proc-filesystem enabled. Dependent of your CAN interface hardware PCI, USB and/or PCCARD support must be enabled with your target kernel configuration.

Manual compilation and installation

A semi-automatic installation with compilation can also be done with little effort. Unpack the tar.gz-files to any directory and start compilation and installation. Please note the prerequisites for compilation of the sources.

As default the driver and its utilities are compiled for chardev usage with support for all hardware interfaces from PEAK. If you need to customize the driver or switch to netdev usage please look at the chapter “Compilation of the driver only”.

```
cd peak-linux-driver-x.y
make clean
make
su -c “make install”
```

Installation itself needs to be root.

After building the sources and the following binary installation on your target computer it's enough to type in

```
/sbin/modprobe pcan
```

to install the driver and any other useful modules. Depending on your requirements you have to do this procedure every time you start your computer or your application. (This may be done in a startup script, too.)

Installation with source RPM

The installation comprise 2 files:

Installation-en.pdf
peak-linux-driver-yyyymmdd-x.y.src.rpm

this installation manual and a source RPM file as base for making a binary RPM file for your target platform.

Note: The term for release or the version for file names can change.

The installation with RPM creates an installable RPM – package with standard settings for the local target system. If the standard settings don't fit you can do a manual installation.

Please type in the command line (as „root“ user):

```
rpm --rebuild peak-linux-driver-20040501-3.3.src.rpm
```

or

```
rpmbuild --rebuild peak-linux-driver-20040501-3.3.src.rpm
```

if the file „peak-linux-driver-20040501-3.3.src.rpm“ is in your current directory.

This invocation expects the previous installation of the gcc-compiler, the kernel-headers and the make tools. Please consider the chapter “Prerequisites for compilation of the sources”.

The compilation for systems with kernel 2.6.x needs an additionally configured kernel and all of the kernel sources.

Depending on your distribution the binary RPM file is stored at „/usr/src/packages/“ or „/usr/src/redhat“.

To do a system specific binary-installation change into this folder and invoke:

```
rpm --install peak-linux-driver-20040501-3.3.i386.rpm
```

Alternatively you can use the GUI based installers „kpackage“ in KDE or „gnorpm“ in GNOME, too.

Loading the driver

Note: Up from the kernel version 2.6.0 the kernel module extension is „ko“.

Register as „root“ user in a console e.g. konsole or xterm. Fork to the „.../peak-linux-driver-x.y/driver“ directory. Type in:

```
/sbin/modprobe parport
```

This command installs the „Parport Subsystem“ with Linux. It is necessary to support the PCAN-Dongle integration (1*, 2*). If the command exits without an error message please invoke

```
/sbin/insmod pcan.o type=xxx,yyy,... io=0x300,0x378,... irq=10,7,...
```

or from kernel 2.6.0 on:

```
/sbin/insmod pcan.ko type=xxx,yyy,... io=0x300,0x378,... irq=10,7,...
```

If you need USB support you have to do the same steps as in „Specifics with the driver installation for USB-PCAN“. The place holder „xxx,yyy,...“ are standing for „isa“, “sp“ or „epp“. The parameter for „io“ and „irq“ can be left out, if the standard assignments are configured with your hardware. PCI-channels, USB-channels and PCCARD based channels are found and installed without any special details but ISA (PC/104) and parallel-port supported channels have to be registered.

The standard assignments for ISA and PC/104 interfaces are (io/irq): 0x300/10, 0x320/5

The standard assignments for Dongle in SP/EPP mode are (io/irq): 0x378/7, 0x278/5

Driver loading specifics for chardev

With the following command you can see any error report after “insmod-ing” (as „root“ user):

```
tail  /var/log/messages
```

Normally the output looks similar to this (depending on your hardware interfaces and your configuration settings):

```
Mar  6 17:35:26 sheila kernel: pcan: Release_20070221_n
Mar  6 17:35:26 sheila kernel: pcan: driver config [mod] [isa] [pci] [dng] [usb] [pcc]
Mar  6 17:35:26 sheila kernel: pcan: pci device minor 0 found
Mar  6 17:35:26 sheila kernel: pcan: pci device minor 1 found
Mar  6 17:35:26 sheila kernel: pcan: usb hardware revision = 28
Mar  6 17:35:28 sheila kernel: pcan: usb device minor 32 found
Mar  6 17:35:28 sheila kernel: pcan: PEAK PC_CAN_CARD 001 A1
Mar  6 17:35:28 sheila kernel: pcan: pccard device minor 40 found
Mar  6 17:35:28 sheila kernel: pcan: pccard device minor 41 found
Mar  6 17:35:28 sheila kernel: pcan: pccard firmware 1.5
Mar  6 17:35:28 sheila kernel: pcan: major 253.
```

To check the correct installation of the driver please invoke:

```
cat  /proc/pcan
```

You'll get a similar printout if there are no errors:

```
*------------ PEAK-Systems CAN interfaces (www.peak-system.com) -------------
*-------------------------  Release_20070221_n  --------------------------
*------------------- [mod] [isa] [pci] [dng] [usb] [pcc] --------------------
*---------------------- 8 interfaces @ major 253 found -----------------------
*n -type- ndev --base-- irq --btr- --read-- --write- --irqs-- -errors- status
 0    pci -NA- ec00b000 010 0x001c 00000000 00000000 00000000 00000000 0x0000
 8    isa -NA- 00000300 010 0x001c 00000000 00000000 00000000 00000000 0x0000
 9    isa -NA- 00000320 010 0x001c 00000000 00000000 00000000 00000000 0x0000
16     sp -NA- 00000378 007 0x001c 00000000 00000000 00000000 00000000 0x0000
32    usb -NA- ffffffff 255 0x001c 00000000 00000000 00000000 00000000 0x0000
33    usb -NA- 20003412 033 0x001c 00000000 00000000 00000000 00000000 0x0000
40 pccard -NA- 00000400 005 0x001c 00000000 00000000 00000000 00000000 0x0000
41 pccard -NA- 00000420 005 0x001c 00000000 00000000 00000000 00000000 0x0000
```

As default the driver is configured for the dynamic allocation of the „major“ number (4*). This is why the device files have to be generated newly every time after driver installation. Please invoke the shell script for this:

```
./pcan_make_devices  2
```

This script installs two device files for each PCI, ISA, PCCARD, Dongle Devices in SP and EPP mode (3*) and USB-devices. Please verify the result with the command:

```
ls  -l  /dev/pcan*
```

Now you already can do your first test with your CAN hardware. Just connect a CAN-transmitter to your CAN interface and send telegrams with bit rate setting of 500 kbit/sec . Login at a user-console and invoke:

- cat /dev/pcan0 for the first PCAN-PCI interface
- cat /dev/pcan8 for the first PCAN-ISA or PCAN-PC/104 interface
- cat /dev/pcan16 for the first PCAN-Dongle interface in SP-mode
- cat /dev/pcan24 for the first PCAN-Dongle interface in EPP-mode
- cat /dev/pcan32 for the first PCAN-USB interface (*9)

- cat /dev/pcan40 for the first PCAN-PC Card interface

The received telegrams should be shown (5*). This invocation can be made at more than one console for more than one interface at the same time.

Output of data is already possible. With the call of:

```
echo „m s 0x234 2 0x11 0x22“ > /dev/pcan0
```

for example a CAN telegram with standard frame is transmitted with the identifier 0x234 and two data bytes „0x11“ and „0x22“ from the first PCAN-PCI interface. The bit rate of the interface can as well be set from the so called „write interface“.

Driver loading specifics for netdev

With the following command you can see any error report after “insmoding” (as „root“ user):

```
tail  /var/log/messages
```

Normally the output looks similar to this (depending on your hardware interfaces and your configuration settings):

```
Mar  6 17:39:51 sheila kernel: pcan: Release_20070221_n
Mar  6 17:39:51 sheila kernel: pcan: driver config [mod] [isa] [pci] [dng] [usb] [pcc] [net]
Mar  6 17:39:51 sheila kernel: pcan: pci device minor 0 found
Mar  6 17:39:51 sheila kernel: pcan: pci device minor 1 found
Mar  6 17:39:51 sheila kernel: pcan: usb hardware revision = 28
Mar  6 17:39:53 sheila kernel: pcan: registered netdevice can0 for pcan usb hw (minor 32)
Mar  6 17:39:53 sheila kernel: pcan: usb device minor 32 found
Mar  6 17:39:53 sheila kernel: usbcore: registered new driver pcan
Mar  6 17:39:53 sheila kernel: pcan: PEAK PC_CAN_CARD 001 A1
Mar  6 17:39:53 sheila kernel: pcan: pccard device minor 40 found
Mar  6 17:39:53 sheila kernel: pcan: registered netdevice can1 for pcan pccard hw (minor 40)
Mar  6 17:39:53 sheila kernel: pcan: pccard device minor 41 found
Mar  6 17:39:53 sheila kernel: pcan: registered netdevice can2 for pcan pccard hw (minor 41)
Mar  6 17:39:53 sheila kernel: pcan: pccard firmware 1.5
Mar  6 17:39:53 sheila kernel: pcan: registered netdevice can3 for pcan pci hw (minor 0)
Mar  6 17:39:53 sheila kernel: pcan: registered netdevice can4 for pcan pci hw (minor 1)
Mar  6 17:39:53 sheila kernel: pcan: major 253.
```

After insmod you have to bring your network devices up, for example:

```
ifconfig can0 up
```

Depending on the configuration of your system (hotplugging, etc.) you might get a log entry like:

```
Mar  6 17:39:53 sheila ifup:     can0
Mar  6 17:39:53 sheila ifup:              No configuration found for can0
```

as the CAN network device is currently not recognized and handled by these 'hotplugging' scripts. It's save to ignore these kind of log messages.

Before 'modprobing' the netdev prepared modules you should edit your /etc/modprobe.conf (or /etc/modprobe.conf.local or /etc/modules.conf, depending on your kernel version and distribution) and add at least this lines:

```
# protocol family PF_CAN
alias net-pf-29 can

# protocols in PF_CAN
alias can-proto-1 can-raw
```

```
alias can-proto-2 can-bcm

# protocol module options
#option can-tpgen printstats=1
#option can       stats_timer=0

# virtual CAN devices
alias vcan0 vcan
alias vcan1 vcan
alias vcan2 vcan
alias vcan3 vcan

# CAN hardware (uncomment the currently used)

#> Peak System hardware (ISA/PCI/Parallelport Dongle, USB, PC Card)
#> to set initial BTR-values set and hardware dependent settings
alias can0 pcan
alias can1 pcan
alias can2 pcan
alias can3 pcan
#options pcan assign=peak
#options pcan type=isa,isa io=0x2C0,0x320 irq=10,5 btr=0x4914
#options pcan type=epp btr=0x4914
#options parport_pc io=0x378 irq=7
```

Depending on the desired target hardware interfaces and transport protocols you may need more entries. Please look into the Socket-CAN documentation for more information.

With the special 'assign=peak' module load parameter you can assign the network device names of the CAN channels corresponding to the assigned minor numbers, e.g. network device name “can40” corresponds devices minor number 40.

If you omit this parameter the network device names are automatically assigned in channel initialization order.

A third option allows to assign individual network device names. To accomplish it please add a string similar to this:

```
assign=pcan32:can1,pcan41:can2
```

Please note: With kernels 2.4.x you should use a plus (+) instead a comma (,) to separate the entries.

To check the correct installation of the driver please invoke:

```
cat  /proc/pcan
```

You'll get a similar printout if there are no errors:

```
*------------ PEAK-Systems CAN interfaces (www.peak-system.com) -------------
*-------------------------  Release_20070221_n  --------------------------
*---------------- [mod] [isa] [pci] [dng] [usb] [pcc] [net] -----------------
*---------------------- 6 interfaces @ major 253 found ----------------------
*n -type- ndev --base-- irq --btr- --read-- --write- --irqs-- -errors- status
 0    pci can2 f7d00000 209 0x001c 00000000 00000000 00000000 00000000 0x0000
 1    pci can3 f7d00400 209 0x001c 00000000 00000000 00000000 00000000 0x0000
32    usb can0 00000000 033 0x001c 00000000 00000000 000000a6 00000000 0x0000
33    usb can1 00000000 255 0x001c 00000000 00000000 00000000 00000000 0x0000
40 pccard can4 00000180 169 0x001c 00000000 00000000 00000000 00000000 0x0000
41 pccard can5 000001a0 169 0x001c 00000000 00000000 00000000 00000000 0x0000
```

The 'ndev' column shows the network device assignment. For assignment of bit rates to network devices you can either set the desired bit rate as module load parameter or you can assign the bitrate after loading the driver with a simple command line invocation like:

```
echo "i 0x4914 e" > /dev/pcan0
```

For this reason it is important to create the chardev-device-entries with the script

```
./pcan_create_devices 2
```

even if only the netdev driver ist used.

To test the correct installation of the netdev driver you can use the Socket-CAN utility “candump”.

```
$ candump
Usage: candump [can-interfaces]
  (use CTRL-C to terminate candump)
Options: -m <mask>   (default 0x00000000)
         -v <value>  (default 0x00000000)
         -i <0|1>    (inv_filter)
         -e <emask>  (mask for error frames)
         -t <type>   (timestamp: Absolute/Delta/Zero)
         -c          (color mode)
         -a          (enable additional ASCII output)
         -s <level>  (silent mode - 1: animation 2: nothing)
         -b <can>    (bridge mode - send received frames to <can>)
         -l          (log CAN-frames into file)
         -L          (use log file format on stdout)
```

To receive from any CAN netdevice you might also invoke

```
candump any
```

instead of working with specific CAN netdevices:

```
candump can0 can2
```

Interface Specifics

Specifics with the driver installation for PCAN-USB

For using the driver the USB subsystem of the Linux kernel has to be enabled. USB support for Linux was first introduced with kernel 2.4. The use of PCAN-USB together with a Linux kernel version less than 2.4.7 is deprecated through the driver developer.

Specifics with the driver installation for PCAN-PC Card

The user side of the PCMCIA subsystem of the kernel has undergone heavy changes through subsequent releases of kernel 2.6.x . So we have to distinguish between the implementations:

Up from kernel 2.6.13 the vendor and card IDs are not any more registered in the configuration file “/etc/pcmia/config” since the relationship between manufacturer-ID and device-ID of the card and the associated driver is registered inside the driver. The driver should be loaded before card plugin.

With this kernel versions you can use the pccardctl utility from the pcmcia-package, especially “pccardctl eject” and “pccardctl insert” to prepare a card for ejection or to notify a inserted card. The former utility to do the same was called cardctl.

For earlier kernel versions than 2.6.13 you need entries in “/etc/pcmcia/config” like:

```
device “pcan”
class “none” module “pcan”

card “PCAN-PCCARD”
manfid 0x0377, 0x0001
bind “pcan”
```

With this entries you can use your configured hotplug system to load the driver when the card is plugged in.

Also for kernels lower than 2.6.13 you can use the cardctl utility from the pcmcia-package, especially “cardctl eject” and “cardctl insert” to prepare a card for ejection or to notify a inserted card.

Please note that removing a card with still open channels is not recommended.

Customization of 'modules.conf' or 'modprobe.conf'

For kernel version 2.6.x the configuration file name has changed to 'modprobe.conf' file. Both files are to find in „/etc“.

At the end of the „/etc/modules.conf“ file („modprobe.conf“) a marked addition is added through the installation. The respective type and the eventually non-standard base addresses and interrupt numbers are to be given there, if the driver have to support the PCAN-ISA or PCAN-Dongle interfaces. (Have a look at the description about the manual loading of the driver)

Note: As soon as there already is an entry with the word 'pcan' the current entry is not to be changed. If you wish to have a new entry you have to delete the old one first. To do that you have to use an editor as „root“ user.

Interface hardware type

To register non-hot pluggable devices permanently you have to use this settings:

```
type=type1,type2[,...]
```

where type* is “isa”, or “sp”, or “epp” depending on your interface hardware.

Example:

```
type=isa,sp
```

IO-port and interrupt settings

If you like to use non-standard settings for IO-ports or interrupt number assignments you have to add:

```
io=io1,io2[,...] irq=irq1,irq2[,...]
```

where io* is the hexadecimal number of the corresponding IO-port and irq* is the decimal number of the assigned interrupt line.

Examples:

```
io=0x300,0x378 irq=10,7
```

The standard assignments for ISA and PC/104 interfaces are (io/irq): 0x300/10, 0x320/5.

The standard assignments for Dongle in SP/EPP mode are (io/irq): 0x378/7, 0x278/5

Initial bitrate

To prevent a wrong initial bitrate when loading the driver we added a driver load parameter which sets the initial bitrate of the related interfaces. For example to set the initial bitrate to 1 Mbit/sec the syntax is:

```
bitrate=0x0014
```

In order to make this setting persistent you have to modify /etc/modules.conf or /etc/modprobe.conf (depending on your kernel version).

Note: Please consider that all interfaces handled with this driver get the same initial bitrate. The corresponding (common) bitrate codes are:

```
#define CAN_BAUD_1M     0x0014  //   1 Mbit/s
#define CAN_BAUD_500K   0x001C  // 500 kBit/s
#define CAN_BAUD_250K   0x011C  // 250 kBit/s
#define CAN_BAUD_125K   0x031C  // 125 kBit/s
#define CAN_BAUD_100K   0x432F  // 100 kBit/s
#define CAN_BAUD_50K    0x472F  //  50 kBit/s
#define CAN_BAUD_20K    0x532F  //  20 kBit/s
#define CAN_BAUD_10K    0x672F  //  10 kBit/s
#define CAN_BAUD_5K     0x7F7F  //   5 kBit/s
```

Assign parameter (netdev only)

There are three choices to assign a network device name to CAN interfaces:

```
assign=peak
assign=device-node-name:network-device-name[, ... ]
not set
```

With the special 'assign=peak' module load parameter you can assign the network device names of the CAN channels corresponding to the assigned minor numbers, e.g.

network device name “can40” corresponds devices minor number 40.

A third option allows to assign individual network device names. To accomplish it please add a string similar to this:

```
assign=pcan32:can1,pcan41:can2
```

Please note: With kernels 2.4.x you should use a plus (+) instead a comma (,) to separate the entries.

If you omit this parameter the network device names are automatically assigned in channel initialization order.

Installation test, use of test programs (chardev only)

Two test programs are attached for the initial test of the interfaces. For using the programs please change to the directory „.../peak-linux-driver-x.y/test“.

Please invoke

```
./receivetest --help
```

You get following response:

```
receivetest Version “Release_20040412_a”  (www.peak-system.com)
--------- Copyright (C) 2004 PEAK System-Technik GmbH ---------
receivetest comes with ABSOLUTELY NO WARRANTY.     This is free
software  and you are welcome  to redistribute it under certain
```

```
conditions.   For   details   see    attached   COPYING   file.

Receivetest – a small test program which receives and prints CAN messages.
Usage: receivetest{[-f=devicenode]|{[-t=type] [-p=port [-i=irq]]}}[-b=BTR0BTR1][-e]
options: -f – devicenode – path to devicefile, default=/dev/pcan0
-t – type of interface, e.g. 'pci', 'sp', 'epp', 'isa' or 'usb' (default: pci).
-p – port in hex notation if applicable, e.g. 0X378 (default: 1st port of type).
-i – irq in dec notation if applicable, e.g. 7 (default: irq of 1st port).
-b – BTR0BTR1 code in hex, e.g. 0X001C (default: 500 kbit).
-e – accept extended frames. (default: standard frames)
-? or --help – this help

receivetest: finished (0).
```

The default bit-rate settings for all CAN-interfaces is set to 500 kbit/sec. The bit rate can be customized through the command line parameters.

For using a ISA or Dongle interface with the standard settings following detail is enough:

```
receivetest -t=isa  or  receivetest -t=sp or receivetest  -t=epp
```

or

```
receivetest  -f=/dev/pcan0
```

to get to the first PCAN-PCI-interface.

Every received telegram of the interface will be print out. Entering Ctrl-C cancels the program.

The program „transmitest“ can be used to transmit data. Please invoke

```
./transmitest –help
```

You get following output similar to receivetest:

```
transmitest Version "Release_20040412_a"  (www.peak-system.com)
--------- Copyright (C) 2004 PEAK System-Technik GmbH ---------
transmitest comes with ABSOLUTELY NO WARRANTY.     This is free
software  and you are welcome  to redistribute it under certain
conditions.   For   details   see    attached   COPYING   file.

Transmitest – a small test program which sends CAN messages.
Usage: transmitest filename {[-f=devicenode]|{[-t=type][-p=port[-i=irq]]}} ...
options: filename – mandatory name of message description file.
-f – devicenode – path to devicefile, default=/dev/pcan0
-t – type of interface, e.g. 'pci', 'sp', 'epp' ,'isa' or 'usb' (default: pci).
-p – port in hex notation if applicable, e.g. 0X378 (default: 1st port of type).
-i – irq in dec notation if applicable, e.g. 7 (default: irq of 1st port).
-b – BTR0BTR1 code in hex, e.g. 0X001C (default: 500 kbit).
-e – accept extended frames. (default: standard frames)
-? or --help – this help

transmitest: finished (0).
```

This program expects similar parameters as receivetest with the exception of a file name. In the file with this name the program expects a list of telegram descriptions which are to be send. Those telegrams will be send cyclic until the ending by pressing Ctrl-C. The syntax of the description of the telegrams is:

Description of the first column of the telegram of the read/write interface.

Tag / Column #1	Description
m	Message string follows
r	RTR-Message string follows
i	Initialisation string follows (write only)
#	Comment follows (write only)

Column	Description
2	s = Standard frame, e = Extended frame
3	Identifier (hex)
4	Length of telegram (dec)
5..12	Telegram bytes (hex)
13	Timestamp milli seconds (dec, read only)
14	Timestamp micro seconds (dec, read only)
13	Comment (write only)

Description of the following columns of 'normal' and RTR-telegrams.

Column	Description
2	BTR0BTR1 Init data (hex, write only)
3	e = allow extended frames (write only)

Description of the following columns for initializing strings.

For example:

```
# a comment
# a message, standard frame, id=0x123, 0 Data bytes
m s 0x123 0
# a message, standard frame, id=0x123, 1 Data byte, Data
m s 0x123 1 0x11
# a message, standard frame, id=0x123, 1 Data byte, Data
m s 0x123 2 0x11 0x22
# a message, extended frame, id=0x123, 3 Data byte, Data
m e 0x123 3 0x11 0x22 0x33
# a RTR, standard frame, id=0x123, 0 Data byte, comment
r s 0x123 0   # a comment
# a RTR, extended frame, id=0x123, 0 Data byte, comment
r e 0x123 0   # a comment
# initialize
i 0x1234 e
```

Most important chardev header files

Any sources of the driver, of the library and the test programs are fit in underneath the „peak-linux-driver-x.y“ directory tree. Two files are to be mentioned especially:

The file „.../peak-linux-driver/driver/pcan.h“ describes the interface to the driver and command constants. You have to include this file if you want to have direct access to the driver with „open(), ioctl(), read(), close() etc.“.

The file „.../peak-linux-driver/lib/libpcan.h“ describes the interface to the dynamic linkable library libpcan.so. You have to include this file if your application needs to use the dynamic library.

Please note that libpcan.h is including the pcan.h file.

Manual installation of the chardev header-files

Please copy the header-files into the directory „/usr/include“ as “root” user as followed

and customize the access rights.

```
cp peak-linux-driver/driver/pcan.h  /usr/include/pcan.h
chmod 644 /usr/include/pcan.h
cp peak-linux-driver/lib/libpcan.h  /usr/include/libpcan.h
chmod 644 /usr/include/libpcan.h
```

Most important netdev header files

For application programs important header file “can.h” and other includes should be taken from the Socket-CAN source. Appropriate Makefiles can be found e.g. at socketcan/trunk/can-utils .

Compilation of the driver only

Use cases

In some cases of using the installed driver it doesn't fit to the configured operating system. This could be following cases:

1. Your kernel sources are not to be found in the standard directory „/usr/src/linux“. You still can compile with following invocations:

   ```
   cd ~/peak-linux-driver-x.y/driver
   make clean
   make KERNEL_LOCATION=<path-to-my-kernel>
   ```

2. You don't need or don't want support for some interface types. Then you have to compile the driver with disabled support for some interfaces. The makefile provides to enable or disable partial compilation with this switches:

   ```
   USB = USB_SUPPORT    or NO_ USB_SUPPORT
   PCI = PCI_SUPPORT    or NO_ PCI_SUPPORT
   DNG = DONGLE_SUPPORT or NO_ DONGLE_SUPPORT
   ISA = ISA_SUPPORT    or NO_ ISA_SUPPORT
   PCC = PCCARD_SUPPORT or NO_PCCARD_SUPPORT
   NET = NETDEV_SUPPORT or NO_NETDEV_SUPPORT
   ```

   As default all interfaces are enabled. For example if you want to suppress PCAN-Dongle and PCAN-ISA Interfaces you have to compile:

   ```
   cd ~/peak-linux-driver-x.y/driver
   make clean
   make DNG=NO_DONGLE_SUPPORT ISA=NO_ISA_SUPPORT
   ```

   As default the netdev driver is disabled. If you like to use the netdev driver please compile with

   ```
   NET=NETDEV_SUPPORT.
   ```

3. The following section only applies to kernel versions 2.4.x or lower: The driver is to be installed on RedHat Linux. RedHat in contrast to SuSE as default uses the „CONFIG_MODVERSIONS“ modifier to prohibit the installation of improper drivers. If your operating system was generated with enabled „CONFIG_MODVERSIONS“ you can see this easily by invoking „cat /proc/ksyms“. If there are cryptic number-letter combinations at the end of the symbols your system was generated with enabled„CONFIG_MODVERSIONS“.

   A simple new compilation on your system is enough:

   ```
   cd ~/peak-linux-driver-x.y/driver
   ```

```
make clean
make
```

4. Your operating system doesn't support the PARPORT_SUBSYSTEM or you have a parallel interface which is unknown to the operating system and you like to use a PCAN-Dongle with this interface.

   Here you have to compile with the „PAR=NO_PARPORT_SUBSYSTEM“ switch:

```
cd  ~/peak-linux-driver-x.y/driver
make clean
make PAR=NO_PARPORT_SUBSYSTEM
```

5. You get runtime errors and want to see more information for diagnosis at „/var/log/messages“. Here you have to translate with the „DBG=DEBUG“ switch:

```
cd  ~/peak-linux-driver-x.y/driver
make clean
make DBG=DEBUG
```

Combinations of these switches are also possible.

Support for Cross-Compilation

The driver, its library and the test programs sometimes are used on other systems than the development system. The process of generating the binary driver for another target is called Cross-Compilation. Partially the driver and its helper programs are supporting Cross-Compilation. Therefore the driver has to be translated with the option.

```
make KERNEL_LOCATION=<path-to-my-kernel>
```

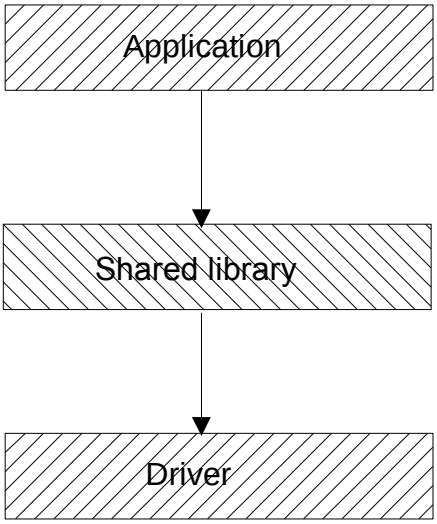
Whether the driver can be compiled for every possible target system and is working there can’t be guaranteed because of so many different architectures.

The installation of the driver and the library on an other target than the host system can’t be supported through the given installation scripts.

We are glad about hints how to improve the Cross-Compilation support. Especially we are looking for successful ports of the driver to document the knowledge for other engineers.

Features of the shared library 'libpcan.so' (chardev only)

The „libpcan.so“ library is providing an easier interface for using the features of the PCAN-drivers. The library interface is similar to the one from MS-Windows and make the porting of applications easier. There are also some calls which adapt better to the specifics of Linux. They are marked with a 'LINUX_..' as prefix. (Example: HANDLE LINUX_CAN_Open(char *szDeviceName, int nFlags);)



Picture 1. calling hierarchy

The interface of the library is described within the C/C++-header file „libpcan.h“. Please note that „libpcan.h“ includes the „pcan.h“ file.

The source code is under LGPL so it is for utilizing within proprietary software without any exceptions.

Manual installation of the chardev shared library

Please change to the directory „../peak-linux-driver-x.y/lib“. Login as „root“ user and invoke:

```
cp libpcan.so.0.1 /usr/lib/libpcan.so.0.1
ln -sf /usr/lib/libpcan.so.0.1 /usr/lib/libpcan.so.0
ln -sf /usr/lib/libpcan.so.0 /usr/lib/libpcan.so
```

This process is only necessary if you install this program for the first time or if you want to update the library. To use the test programs the library has to be installed.

Note: The version minor number of the library can change as a result of minor or major improvements.

Message Filters (chardev only)

Up from driver version 6.0 message filters are supported for the chardev device. With the netdev device message filters are part of Socket-CAN.

To maintain backward compatibility, after first open of a path to a device no message filter

is set. With the first time a message filter is set or reset the message filter chain will be activated.

It is possible to set more than one filter condition in a message chain for each path. After a message is received the filter chain is walked trough to check for a pass condition. If no pass condition is found the message is rejected.

Error handling

The CAN error handling for the chardev driver has changed from version 5.x to version 6.x of the driver. Now the handling is more compatible to the MS-DOS implementation.

If a CAN error occurs a status message is enqueued into the channels receive queue. A status message is marked with MSGTYPE_STATUS set in the MSGTYPE field of the TPCANMsg structure.

Depending on the kind of error detailed CAN_ERR_... information is set in the DATA[3] field of the same structure.

Error handling with netdev devices is similar, however the error information is fit into the can_frame structure. For details please look into the Socket-CAN documentation.

Socket-CAN introduction and basic installation (netdev only)

The Socket-CAN package is an implementation of CAN protocols (Controller Area Network) for Linux. CAN is a networking technology which has wide-spread use in automation, embedded devices, and automotive fields. While there have been other CAN implementations for Linux based on character devices, Socket-CAN uses the Berkeley socket API, the Linux network stack and implements the CAN device drivers as network interfaces. The CAN socket API has been designed as similar as possible to the TCP/IP protocols to allow programmers, familiar with network programming, to easily learn how to use CAN sockets. (Taken from the README file from the Socket-CAN package).

The development on Socket-CAN started end of 2002 at Volkswagen AG to have a common CAN-IT-interface for HMI- and Car2Car prototypes. Nowadays Socket-CAN is maintained by a group of developers at http://socketcan.berlios.de/. One of the Socket-CAN maintainers, Oliver Hartkopp, did most of the netdev integration into the plain pcan driver.

To use Socket-CAN you first have to fetch the Socket-CAN sources and compile and load them. To fetch the sources you might invoke:

```
svn co http://svn.berlios.de/svnroot/repos/socketcan/trunk /where/it/should/load
```

Then please follow the instructions given in the README file to compile and load Socket-CAN. With Socket-CAN you get a driver for “virtual CAN channels”. They are called vcan0, vcan1 and so on.

To get the Socket-CAN loaded you can invoke as root-user:

```
modprobe can
modprobe can-raw
modprobe can-bcm
modprobe vcan
```

to load the necessary modules. You might look into your kernel-log (e.g. /var/log/messages) to see the module banners printed at load time.

After loading you'll get this lsmod output

```
lsmod | grep can
can_bcm                16392  0
can_raw                 9856  0
can                    36072  2 can_bcm,can_raw
vcan                    4360  0
```

Now you only have to bring up your new network nodes. For example please invoke:

```
ifconfig vcan0 up
```

This starts the network device vcan0. To see if the network device is installed please call:

```
ifconfig
vcan0 Protokoll:UNSPEC  Hardware Adresse 00-00-00-00-00-00-00-00-00-00-00-00-...
RX packets:0 errors:0 dropped:0 overruns:0 frame:0 TX packets:0 errors:0 dropped:0 ...
carrier:0 collisions:0 Sendewarteschlangenlänge:1000 RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

eth0      ...

lo        ...
```

With this basic installation you can test your Socket-CAN setup. To test it you must have the Socket-CAN can-utilities compiled. In a first console invoke:

```
./cangen vcan0
```

If you invoke in a second console "candump vcan0" then you'll get the generated (and loopbacked) CAN messages from your first invocation:

```
./candump vcan0
vcan0  567  [6] 69 98 3C 64 73 48
vcan0  451  [8] 4A 94 E8 2A EC 58 55 62
vcan0  729  [8] BA 58 1B 3D AB D7 7E 50
vcan0  1F2  [8] E3 A9 E2 79 46 E1 45 75
```

This output shows that your basic Socket-CAN installation was successful. Next you have to install the pcan netdev driver.

Note: Currently most of the Socket-CAN utilities can only be used as root-user. Due to the standard NET-CAPABILITIES the access to the RAW-sockets and to the BCM-sockets are only granted to the user root (analogue to the promiscuous mode on ethernet devices). But you may define CONFIG_CAN_RAW_USER and/or CONFIG_CAN_BCM_USER in the Kconfig (when integrated into the Kernel) to override this.

You may also try to put

```
#define CONFIG_CAN_RAW_USER
#define CONFIG_CAN_BCM_USER
```

into your local /usr/src/linux/include/linux/autoconf.h before compiling the Socket-CAN source code or change the files raw.c and bcm.c after downloading Socket-CAN.

This is a disadvantage of the 'external' module compilation.

For additional support on Socket-CAN you may also check the mailing-lists at http://developer.berlios.de/projects/socketcan/ :

http://developer.berlios.de/mail/?group_id=6475

Realtime support with Xenomai

Since Release ‘release_20061029_*’ realtime support for the Xenomai realtime environment (http://www.xenomai.org/) was merged from a previous rt-branch into the main branch. Most of the work was done by Laurent Bessard and Edouard Tisserant.

The Xenomai project has been launched in August 2001. It has merged in 2003 with the RTAI project [http://www.gna.org/projects/rtai/] to produce an industrial-grade real-time Free Software platform for GNU/Linux called RTAI/fusion, on top of Xenomai’s abstract RTOS core.

Installation

First of all, in order to install pcan-rt driver, a Xenomai realtime environment must be installed on your workstation. Download the Xenomai source code from the Xenomai website and install it by following the installation manual provided. The Linux kernel of your workstation must be patched for using Adeos (patches for a lot of architectures are included in the source code).

Before using Xenomai, the list of dynamic libraries of your workstation must be updated. If not, the driver compilation will abort. For that, you can use ‘ldconfig’, ensuring that the path to Xenomai libraries have been added to ‘/etc/ld.so.conf’ file.

Compilation environment

To compile the pcan realtime driver, you must provide in the make command the option RT=XENOMAI. By default, the pcan driver will be compiled for non-realtime environment.

Because USB and PCCARD are still not supported on pcan realtime driver, it is highly recommended to not compile pcan realtime driver with USB_SUPPORT or PCCARD_SUPPORT flags.

An example of command for compiling pcan realtime driver:

```
cd ~/peak-linux-driver/driver
make clean
make RT=XENOMAI
```

Runtime environment

You can load pcan realtime driver module as usual, there are no changes compared to the standard loading procedure.

The pcan API is the same in realtime and non-realtime, so you can open, close, read from or write to your pcan device like usual. But be careful, reading and writing must be made in a realtime task to be really effective. For an example of how to use Xenomai for creating and using a realtime task, please refer to the examples (transmitest and receivetest) located in the ‘test’ folder.

For compiling your program, Xenomai libraries path and flags must be included in your ‘Makefile’. They can’t be obtained by using the ‘xeno-config’ script provided with Xenomai. You can have an example of how using ‘xeno-config’ in the ‘Makefile’ file located in the ‘test’ folder.

Troubleshooting

Warning: On an old station, after compiling the kernel patched for Adeos, a problem that makes the kernel couldn’t load can appear. To solve this problem, you can added ‘lapic=1’ to the kernel command line parameters in ‘grub.conf’ or ‘lilo.conf’ file, depending of your bootloader.

If your kernel still crashes at start, a solution for finding what is blocking your kernel is to compile it with Xenomai support in module and try to insert it after kernel was loaded. It will then indicate in the log messages what the problem is.

The most common mistake when using a realtime task is trying to print some text in the user terminal with ‘printf’ command. It is highly recommended to avoid to do that. In most cases, it will result in a kernel crash.

FAQ

Q. The driver for my PCAN-ISA card is not being installed. What's wrong?

A. One possibility is that the SJA-1000 chip on the card is setting back while checking the PeliCAN-mode. If the card with a PLD that has got a red point and the jumper JP11 is set „on“ this may be the reason. Remedy: To set the jumper to „off“.

Q. My PCAN-ISA, CAN-PC/104 or PCAN-Dongle doesn't receive any data though I can send. What's wrong?

A. A possible reason is that a wrong interrupt is configured for the device. Then single telegrams can be send however none can be received. Not only the wrong assertion of the interrupt number but often the missing release of the interrupt in BIOS („legacy ISA“) for the PCAN-ISA card can be the reason. (See also (1*))

Q. My PCAN-Dongle is being rejected while using it even if the installation was successful. What's wrong?

A. Normally the reason is a not assigned interrupt for the „parport_pc“ while using it together with the PARPORT_SUBSYSTEM (1*).

Q. What possibilities do I have to diagnose if I have problems?

A. Linux has a variety of choices. First it's useful to look at recent messages with:

```
“tail -f /var/log/messages“
```

If the driver is loaded you can see (as root) with

```
„/sbin/lsmod | grep pcan“
```

More informations about the parameter of the driver can be asked with.

```
„/sbin/modinfo pcan“
```

Closer information about assignment of major- and minor-numbers and about the use of resources can be queried with

```
“cat /proc/pcan“
```

Information about assignment of resources can be queried with

```
“cat /proc/interrupts“
“cat /proc/ioports“
“cat /proc/iomem“
„cat /proc/pci“ or „cat /proc/bus/pci/devices“ depending on the kernel version.
„cat /proc/bus/usb/devices“
```

Please note that the interrupts of the hardware aren't registered until its use.

To diagnose USB there are also programs with a graphical user interface like e.g. „USBView“.

With garbled installations sometimes paths for lation of the driver are set wrong. That's why while translating the driver a message like this appears:

```
*** Host machine kernel version=2.4.18-4GB, Driver kernel version=2.6.5, \
    Path to kernel sources=/mnt/usr/src/linux, use KBUILD=yes
```

With this message it is possible to compare if the driver is really compiled for the used kernel. The „KBUILD“ mechanism is used from kernel 2.6.x on.

Q. How do I interpret the output of “cat /proc/pcan“ ?

A. The second line gives information about the release of the driver. In the third line the number of the found CAN-channels and the assigned major-number are shown. From line four on the characteristics of the each CAN-channel are described.

The first column shows the minor-number assignment of the channel, the second column shows the type of the channel, the third column shows the network device assigment i available. The fourth column shows the current BTR0BTR1 (bitrate) setting, the next 2 columns show the assignment to base addresses (ports) and interrupt-numbers. The following four columns count the number of processed read-, write-, interrupt- and errors transactions. The last column shows the last occurred error status of the channel. The status is a bit-field with an interpretation like this table:

Bit	Description
0	Chip-send-buffer full
1	Chip-receive-buffer overrun
2	BUS warning
3	BUS passive
4	BUS Off
5	Receive-buffer is empty
6	Receive-buffer overrun
7	Send-buffer is full
14	Illegal parameter

Both columns „base“ and „irq“ are misused with USB channel types. „base“ is showing the serial number of the module and „irq“ the programmed device number of the module. The column „irq“ in case of type USB counts the number of received or sent USB-packages..

Q. What happens if I plug out the interface while using PCAN-USB?

A. First of all your programs will stall and a re-plug-in of the PCAN-USB doesn’t change anything. First you have to stop and after plugging-in of the interface you can invoke your programs again. It’s not guaranteed that the same minor number as the previous PCAN-USB minor-number is allocated. Minor-number assignment depends on the order of plug-ins of PCAN-USB devices.

Q. How can I find out what minor-number the PCAN-USB is assigned to?

A. With help of the individual pre-programmed „device-number“, which can be experienced with help of the „/proc/pcan“ interface, a relationship to a special physical connection can be made.

Q. I want to open my PCAN-USB device however I get an error message. What's wrong?

A. There is more than one possibility: 1.) The appropriate device is not registered as „/dev/pcan...“. 2.) The appropriate device is not plugged in.

Q. The compilation on my system doesn't work. What can be wrong?

A. The most common reason are not installed Linux kernel sources. Often sources of another kernel than the one installed are used. Sometimes both files

- „/boot/vmlinuz.autoconf.h“ and
- „/boot/vmlinuz.version.h“

of the distribution are not linked to the files they are assigned to.

- „/lib/modules/'uname-r'/build/include/linux/autoconf.h“ and
- „/lib/modules/'uname -r'/build/include/linux/version.h“

Q. The transmission performance of CAN-messages is low, if I send a telegram with help of the write-interface out of a script. What is the problem?

A. Every line in a script opens the path to a device and immediately closes this path again. This opening and closing takes time. The transmission performance can be improved by letting another path open. For example:

```
cat /dev/pcan32 >/dev/null &
echo „m s 0x123  2 0x11 0x12“ > /dev/pcan32
echo „m s 0x123  2 0x11 0x12“ > /dev/pcan32
```

Q. I got a lot of error messages when compiling the driver for a kernel 2.6.x system. What's wrong?

A. To compile for kernel 2.6 target system you need to have a pre-configured kernel. To accomplish this you need to install the target kernel sources. Then do

```
cd /usr/src/linux # for example
su                # you need to be root
make cloneconfig  # create a configuration suitable for your running kernel
make scripts      # create the necessary scripts
```

That's all. Now you can – as ordinary user – compile your driver.

Q. While compiling the driver following message appears:

```
*** “Can't find /usr/src/linux-2.4.24.SuSE/include/linux/version.h !”.  End.
```

What's the problem?

A. Within the driver makefile up from version 3.3 the target kernel version is not being won out of the interpretation of the command 'uname -r', but extracted out of contents of the file „$(KERNEL_LOCATION)/include/linux/include/version.h“. (If there wasn't any

special „KERNEL_LOCATION“ given at the command line of „make“ „KERNEL_LOCATION=/usr/src/linux“ is being used as default.) While translating the kernel sources the file „version.h“ is generated. Normally this message has its cause in not translated kernel sources. Until kernels 2.4.x it was enough if the distribution had installed this file. From kernel 2.6.x on it is necessary that the kernel sources for the target system are configured and translated completely. Then the file „version.h“ is being created.

Q. I like to have interrupt sharing with PCAN-ISA or PCAN-PC/104

A. No problem since version 3.30 of the driver. But you should be aware that interrupt sharing with ISA BUS is only possible with devices which are supported from the same driver, e.g. The pcan driver. For example it is not possible to share a serial device with a pcan device but two pcan devices can share the same interrupt level.

Q. I have problems to compile or load the driver. What can I do?

A. First, read this manual to see if you got a well known problem. Second, if it is a compiling problem then redirect your compiler output into a file and send the contents to linux@peak-system.com. If it is a loading problem do the same for the output of your loading procedure. With loading or runtime problems it is very helpful to run a driver with debug mode enabled. Then please attach the relevant parts of “/var/log/messages”.

Q. I got other questions or problems with the driver.

A. Please consult linux@peak-system.com.

Q. I am enthusiastic about the driver or the documentation and want to contribute something to make it better. Who do I have to consult?

A. Please also contribute linux@peak-system.com. Peak and the authors are happy about every positive response.

Appendix

(1*) = The „Parport Subsystem“ has to be configured to use a interrupt. Therefore following lines have to be entered into the file „/etc/modules.conf“ or „/etc/modprobe.conf“ depending on your kernel version:

```
alias parport_lowlevel parport_pc
options parport_pc io=0x378 irq=7
```

Normally „irq=none“ stands in the „options“-line. The assigned interrupt number must match the assigned interrupt number of the device. Those works can only be done as 'root“. If the „Parport Subsystem“ is already installed it can be removed with:

```
rmmod lp
rmmod pcan
rmmod parport_pc
rmmod parport
```

(2*) = You are not forced to use the „Parport Subsystem“. Then the alternately use of the

parallel port through PCAN-Dongle and e.g. a printer is not possible any more. For it the driver has to be translated with the PAR=NO_PARPORT_SUBSYSTEM option. Then the previous detail of „modprobe parport“ is not necessary while installing.

(3*) = For each type of hardware 8 device-interfaces are reserved. For PCI those are the minor-numbers 0...7, for ISA 8...15, for Dongle in SP-mode 16...23 and for Dongle in EPP-mode 24...31, for PCAN-USB 32..39, for PCAN-PCCard 40..48. Therefore the device files have a name e.g.:

- /dev/pcan0for the first PCI-channel
- /dev/pcan8 for the first ISA-channel
- /dev/pcan16 for the first SP-channel
- /dev/pcan24 for the first EPP-channel
- /dev/pcan32 for the first USB-channel (9*)
- /dev/pcan40 for the first PC Card channel

The invocation of „pcan_make_devices n“ however only creates n device files of each type. According to your demands „n“ can be any number from 1...8.

(4*) = In some cases the dynamic assignment of „major“- device numbers are unwelcome. However this can be changed in the driver sources (file „pcan_main.h“, constant „PCAN_MAJOR“). Afterwards the driver has to be translated and installed again. The best is to use the number „91“. This already is intended for CAN-devices. Please note that conflicts to other installed CAN-drivers can be possible.

(5*) = The „read“- and „write“-interface of the driver print out ASCII formatted data or accept ASCII formatted data as input. The format of the telegrams for „read“ and „write“ is defined identically, so that a redirection of data is possible:

```
cat  /dev/pcan0 > /dev/pcan8
```

The format of the data is like the previously mentioned description of the telegrams. Additionally to the description of the telegrams the „read“-output supplies a time stamp in milliseconds and microseconds. If there is a redirection like above the time stamp is being ignored.

The „write“-output also accepts details about initializing:

```
echo „i 0x1234 e“  > /dev/pcan8
```

The first parameter pinpoints the initialization, the second parameter names an input value for both BTR0/BTR1 registers of the SJA1000 chip. The optional third parameter „e“, enables the accept ion of extended frames.

Naturally a faster „ioctl()“-interface is also defined.

(6*) = CAN hardware is only accepted based on Philips chip SJA1000. PCAN-ISA or -PCI hardware is immediately verified during installation. In contrast to that the PCAN -Dongle hardware is not verified until an „open()“ call. That's the reason why no error is reported if a parallel port without plugged-in PCAN-Dongle is recognized .

(7*) = Sometimes some hardware/software combinations don't recognize the USB-Dongle

after a new start of the system. The red light-emitting diode doesn't shine at the PCAN-USB if that's the case.

(8*) = If lots of faults are generated with enabled USB support while compiling, then a faulty Linux kernel configuration may be the cause. During configuration of the Linux kernel the USB-support has to be enabled.

(9*) = From kernel version 2.6 on the behaviour during assignment of the „minor“-numbers is being changed through the kernel parameter „CONFIG_USB_DYNAMIC_MINORS“. When „CONFIG_USB_DYNAMIC_MINORS“ is set, the first free „minor“-number is assigned to from 0 on. Mandrake distributions uses this configuration.

Historical parts

devfs

Up from Release_20030622_x the device file system is being supported optionally. From kernel version 2.6.x the kernel developers depreciate the use of devfs so for the time being the driver is not supporting this. Up from release release_20060501_a (version 4.0) the parts for supporting devfs are removed from the driver.

Using the devfs it's not necessary to create device files manually any more. This is taken over by the kernel in cooperation with the driver and the daemon devfsd. The device file system has to be enabled within the kernel.

Compiling for devfs-file system support. If you translate the sources for a system with devfs-support (CONFIG_DEVFS_FS = y) this will be considered automatically:

```
cd ~/peak-linux-driver/driver
make clean
make DEVFS=DEFS_SUPPORT
```

Q. I compiled for device file system support. Though it’s not working.

A. Is your devfsd – the „device file system daemon“ – active? Please check that.

Compilation for kernel greater than 2.5.x

Q. While translating kernel 2.6.x following warning appears:

```
*** Warning: Overriding SUBDIRS on the command line can cause
*** inconsistencies
```

Is something not right?

A. I am afraid that the discussion within the kernel-developer community about the right way of translating external modules hasn’t found an end until this release. The current way generates this warning and at worst translates **all** of the modules again. Though there are approaches that the generation of external modules like pcan.ko is getting easier. This message can be ignored.

Obfuscation

Q. The source code module „pcan_usb_kernel.c“ only contains cryptic letters. Is the file destroyed?

A. No, the contents of the files are obfuscated to save intellectual property. Though it’s still a translatable source code. This feature does only apply for releases earlier than 20061029.

Q. During installation of the driver with USB-support I get following message: „Warning: loading pcan.o will taint the kernel: non-GPL license – Proprietary“. What’s the meaning of this message?

A. This message points out that the driver for the PCAN-USB module is not released under the GPL license. The use of the driver as a module within Linux though is legal.

Epilogue

This document was made with help of OpenOffice.org (http://www.openoffice.org). Thanks to the community for such an excellent tool.