

For details, contact:
Thay 'Soma'sundaram
Telephone: 850-644-6448
E-mail: soma@sb.fsu.edu
URL: www.sb.fsu.edu/~soma

Thayumanasamy Somasundaram
414 Kasha Laboratory
Institute of Molecular Biophysics
Florida State University
Tallahassee, FL 32306-4380

Soma's Computer Notes

Procedure for installing a FireWire drive under Linux (Kernel version 2.4.18)

Notes for installing a 80 GB Maxtor FireWire drive (aka IEEE 1394) under Linux. Updated on April 10, 2004; Original Version April 1, 2003.

FireWire drive under Linux



Tallahassee, April 10, 2004: The following note describes how to install an external hard drive with

FireWire (also known as IEEE 1394 or i-LINK) interface under Linux operating system (o/s) kernel ver.

2.4.18. FireWire technology is defined by its developer Apple as:

"FireWire is a cross-platform implementation of the high-speed serial data bus -- defined by IEEE Standard 1394-1995 -- that can move large amounts of data between computers and peripheral devices. It features simplified cabling, hot swapping, and transfer speeds of up to 400 megabits per second."
(<http://developer.apple.com/firewire/>)



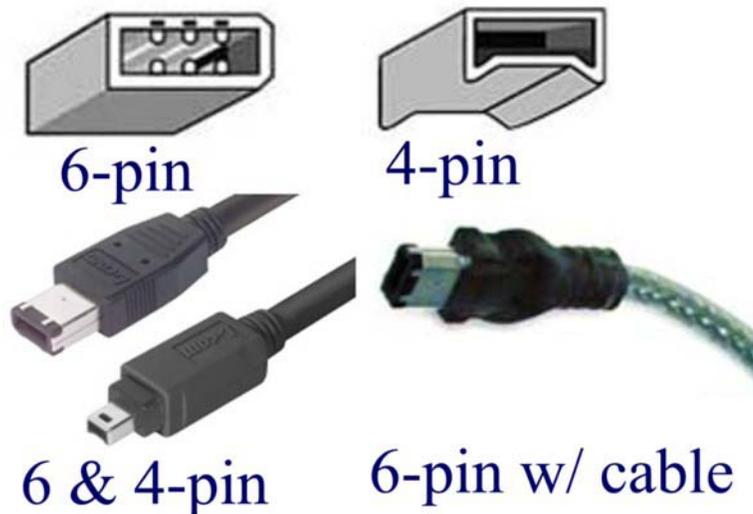
IEEE 1394
(Apple)
Logo



SONY
i-LINK
Logo

FireWire external hard drives allow quick transfer (*high transfer speed*) of large amounts of data, transfer of data between multiple platforms (*cross-platform*), quick access to data (*hot-swappable*), and easy way to transport data sets (*portable*). The note will describe how to integrate a FireWire drive into a Linux system, store and retrieve data from the drive. This note is intended to help the [X-Ray Facility](#) users who may carry a FireWire drive back and forth between home and a synchrotron source.

FireWire devices feature a female port and are usually connected to another female port either at the back of a computer or on another FireWire device using a special cable that has two 6-pin male ends. Some I-LINK devices are connected via a 4-pin interface and 4-pin cable. Pictures of some of the interfaces and cables are shown below:



Installing the drive (may need `root` previlages)

FireWire drives are hot-pluggable and hot-swappable and this means that the operating system should detect the drive soon after it is attached to a computer. In order for this to work, the Linux operating system kernel should have either pre-compiled versions of the following device drivers: IEEE 1394, OHCI 1394, and SBP-2 1394, or the device drivers are added as modules (using `insmod` command). IEEE 1394 is the FireWire protocol, Open Host Controller Interface (OHCI) is the standard that allows a computer host to interface with Firewire and USB devices, Serial Bus Protocol-2 (SBP-2) is used specifically to transport SCSI across a 1394 bus.

While logged in as `root`, power-up the FireWire drive, wait for few seconds and then plug the device to the FireWire interface using the FireWire cable. In principle, the drive should be recognized as a new device by the operating system of the computer and through SBP-2 it should be listed as a SCSI device. Check the `/var/log/dmesg` file to find out the whether the o/s recognized the new device and if so the designation of the device name.

One quick way of checking for the device is to `grep` for 'ieee1394' or 'ohci1394, or '1394' in `/var/log/dmesg` file. A typical `dmesg` output is shown below when a 80 GB Maxtor FireWire drive is hotplugged to a Linux box. Notice the reference to the keywords mentioned in the last sentence:

```
ohci1394_0: OHCI-1394 1.0 (PCI): IRQ=[11] MMIO=[feafd000-
ieee1394: Device added: node 0:1023, GUID 0010b9010131618d
ieee1394: sbp2: Node 0:1023: Max speed [S400] - Max payload [2048]
scsi2 : IEEE-1394 SBP-2 protocol driver

Vendor: Maxtor      Model: 1394 storage      Rev: v1.2
Type:   Direct-Access      ANSI SCSI revision: 06
Attached scsi disk sda at scsi2, channel 0, id 0, lun 0
SCSI device sda: 156355584 512-byte hdwr sectors (80054 MB)
sda: sda1
```

Based on the message above the o/s has detected a Maxtor 1394 SCSI storage device with 80 GB capacity, with direct-access and this device has been assigned a SCSI device label of **sda1**. A typical picture of the external drive from Maxtor is shown below:



Maxtor FireWire External Hard drive (Maxtor 3000 DV; 80 GB)

Drive designation

It is essential to know the device designation before the device can be mounted. One way to get the device designation is by examining the tail portion of `dmesg`. Another way to find the same information is to run

`fdisk -l` or `sfdisk -l` and look for the device designation. Given below is print-out for `sfdisk -l`:

```
Disk /dev/hda: 2205 cylinders, 255 heads, 63 sectors/track
Units = cylinders of 8225280 bytes, blocks of 1024 bytes, counting from 0
  Device Boot Start      End    #cyls   #blocks  Id System
 /dev/hda1 *        0+      521     522-   4192933+  7  HPFS/NTFS
 /dev/hda2          522     847     326    2618595  83  Linux
 /dev/hda3          848     880       33    265072+  83  Linux
 /dev/hda4          881    2204    1324   10635030  5  Extended

Disk /dev/sda: 9732 cylinders, 255 heads, 63 sectors/track
Units = cylinders of 8225280 bytes, blocks of 1024 bytes, counting from 0
  Device Boot Start      End    #cyls   #blocks  Id System
 /dev/sda1      0+      9728    9729-  78148161  83  Linux
end: (c,h,s) expected (1023,254,63) found (512,254,63)
 /dev/sda2          0         -         0         0  0  Empty
```

From the print-out above, we notice that there are two different drives: one IDE harddrive (`/dev/hda`) and one SCSI harddrive (`/dev/sda`). The IDE harddrive has four partitions (`/dev/hda1` through `/dev/hda4`)

and the 80 GB SCSI device has one partition and has the label **sda1**. Once the exact device designation has been known the next step is to mount the device.

Mounting Drive

Remember that under Linux and UNIX operating systems, as opposed to Windows o/s, even a physical device is considered to be a file-system (f/s). This means that the Maxtor harddrive is another file-system and NOT a device in the conventional sense (*so read f/s for a device or a drive*). FireWire drives are often swapped between machines and therefore, it is desirable to mount the device when required rather than auto-mounted. However, it is advisable to add an entry in the `/etc/fstab` file that specifies the mount point, the file system and partitions (if found). From the `sfdisk` output we already know that our external hard drive has one partition with 80 GB capacity. Note that if it is a brand new drive from a PC vendor it is likely to be formatted with `vfat` file system. However, in our case we had earlier modified `vfat` file system to a Linux specific filesystem called `ext3`. So we are going to add an entry in the `/etc/fstab` file that specifies these details and then mount the device (aka f/s).

```
root@tampa /etc]# vi fstab |Edit fstab and add an entry for FireWire drive
Physical Device      Mount Point      Type  Options      Frq  Pass
/dev/sda1            /mnt/fire0      ext3  noauto,owner,rw  0    0

root@tampa /etc]# mkdir -p /mnt/fire | Make a directory name for the mount point
root@tampa./etc]# mount -t ext3 /dev/sda1 /mnt/fire | Mount the FireWire drive

[root@tampa root]# df -k |Find it in the list of mounted disks with correct file system
Filesystem      1k-blocks      Used Available Use% Mounted on
/dev/hda2        2577424      1688336    758160   70% /
/dev/hda6       10206972      114920    9573556    2% /data
/dev/hda3        256665        86192    157220   36% /home
none            127880         0      127880    0% /dev/shm
/dev/sda1       76920416     35902704   37110304   50% /mnt/fire [specific mount pt.]

root@tampa./etc]# mount |Confirming the file system; mount with no options
/dev/hda2 on / type ext3 (rw)
none on /proc type proc (rw)
usbdevfs on /proc/bus/usb type usbdevfs (rw)
/dev/hda6 on /data type ext3 (rw)
none on /dev/pts type devpts (rw,gid=5,mode=620)
/dev/hda3 on /home type ext3 (rw)
none on /dev/shm type tmpfs (rw)
/dev/sda1 on /mnt/fire type ext3 (rw) [specific f/s]
```

Some additional commands that are of value to the `root` during the mounting process are described next.

For example, to confirm the number and nature of the SCSI devices, `root` can issue `cdrecord -scanbus`

command. A typical response will look like the following (here there are two Maxtor FireWire drives):

```
Cdrecord 1.10 (i686-pc-linux-gnu) Copyright (C) 1995-2001 Jörg Schilling
Using libscg version 'schily-0.5'
scsibus0:
```

```

0,0,0    0) 'Maxtor  ' '1394 storage  ' 'v1.2' Disk
0,1,0    1) 'Maxtor  ' '1394 storage  ' 'v1.2' Disk
0,2,0    2) *
0,3,0    3) *
0,4,0    4) *
0,5,0    5) *
0,6,0    6) *
0,7,0    7) *

```

Another way to look at the same information is to examine the text file `/proc/scsi/scsi`.

```

Attached devices:
Host: scsi0 Channel: 00 Id: 00 Lun: 00
  Vendor: Maxtor   Model: 1394 storage   Rev: v1.2
  Type:   Direct-Access                 ANSI SCSI revision: 06
Host: scsi0 Channel: 00 Id: 01 Lun: 00
  Vendor: Maxtor   Model: 1394 storage   Rev: v1.2
  Type:   Direct-Access                 ANSI SCSI revision: 06

```

Once the f/s is mounted, in our case as `/mnt/fire`, the users can access it to write, read, and modify the data found in the drive. Once all the needed data is stored simply unplug the cable connecting the device to a computer, switch off the power supply and carefully pack it for transport.

Mounting Two Devices

This section deals with the process of mounting two FireWire devices, for example, two external drives, or one external drive and a DVD-R drive. Once again we go over the process of finding the designation and mount the drives independently. A typical output for `sfdisk -l` for two external drive may look like the following:

```

Disk /dev/hda: 2205 cylinders, 255 heads, 63 sectors/track
Units = cylinders of 8225280 bytes, blocks of 1024 bytes, counting from 0
  Device Boot Start      End    #cyls  #blocks  Id System
/dev/hda1 *      0+       521    522-   4192933+  7  HPFS/NTFS
/dev/hda2                522     847    326   2618595  83  Linux
/dev/hda3                848     880     33   265072+  83  Linux
Disk /dev/sda: 9732 cylinders, 255 heads, 63 sectors/track
Units = cylinders of 8225280 bytes, blocks of 1024 bytes, counting from 0
/dev/sda1          0+   4177   4178-  33559753+  83  Linux
/dev/sda2        4178   9731   5554  44612505  83  Linux
Disk /dev/sdb: 9732 cylinders, 255 heads, 63 sectors/track
Units = cylinders of 8225280 bytes, blocks of 1024 bytes, counting from 0
/dev/sdb1          0+   9728   9729-  78148161  83  Linux
end: (c,h,s) expected (1023,254,63) found (512,254,63)
/dev/sdb2          0     -      0      0  0  Empty

```

We note that there are three drives: one IDE drive (`/dev/hda`) and two SCSI disks (`/dev/sda` + `/dev/sdb`). The IDE drive has several partitions (`/dev/hda1-hda3`) and the first SCSI disk has two partitions (`/dev/sda1+sda2`) and the second SCSI disk has one partition (`/dev/sdb1`). If we now know what kind of filesystems these drives belong to we can mount them independently.

```

[root@tampa root]# mount /dev/sda1 /mnt/fire1 | Mount with no specific f/s
[root@tampa root]# mount -t reiserfs /dev/sda2 /mnt/fire2 | Mount with specific f/s
[root@tampa root]# df -k
Filesystem          1k-blocks      Used Available Use% Mounted on
/dev/hda2              2577424         1692664    753832   70% /

```

```

/dev/hda6          10206972    114920    9573556    2% /data
/dev/hda3          256665     86221    157191    36% /home
none              127880      0        127880    0% /dev/shm
/dev/sda1         33558720   3869464   29689256   12% /mnt/fire1
/dev/sda2         44611136   34015316  10595820   77% /mnt/fire2
[root@tampa root]# mount -t ext3 /dev/sdb1 /mnt/fire0 | Mount with specific f/s
[root@tampa root]# df -k
Filesystem      1k-blocks      Used Available Use% Mounted on
/dev/hda2         2577424        1692668  753828    70% /
/dev/hda6         10206972       114920   9573556    2% /data
/dev/hda3         256665         86223    157189    36% /home
none             127880         0        127880    0% /dev/shm
/dev/sda1         33558720       3869464   29689256   12% /mnt/fire1
/dev/sda2         44611136       34015316  10595820   77% /mnt/fire2
/dev/sdb1         76920416       35902704  37110304   50% /mnt/fire0
[root@tampa root]# mount |Just confirm the f/s by issuing mount command with no arguments
/dev/hda2 on / type ext3 (rw)
none on /proc type proc (rw)
usbdevfs on /proc/bus/usb type usbdevfs (rw)
/dev/hda6 on /data type ext3 (rw)
none on /dev/pts type devpts (rw,gid=5,mode=620)
/dev/hda3 on /home type ext3 (rw)
none on /dev/shm type tmpfs (rw)
/dev/sda1 on /mnt/fire1 type reiserfs (rw)
/dev/sda2 on /mnt/fire2 type reiserfs (rw)
/dev/sdb1 on /mnt/fire0 type ext3 (rw)

```

If, instead of two external harddrives, there is one FireWire drive and one FW dvd-rom drive (see for more

details, [NFS DVD Linux.doc](#)) then we mount them separately as shown below:

```

[root@tampa root]# mount -t ext3 /dev/sda1 /mnt/fire1 | Mount with specific f/s
[root@tampa root]# mount -t iso9660 -o ro /dev/scd0 /mnt/fw-dvd | Mount dvd
[root@tampa root]# df -k
Filesystem      1k-blocks      Used Available Use% Mounted on
/dev/hda2         2577424        1692388  754108    70% /
/dev/hda6         10206972       114920   9573556    2% /data
/dev/hda3         256665         86300    157112    36% /home
none             127880         0        127880    0% /dev/shm
/dev/scd0         3942432        3942432    0        100% /mnt/fw-dvd
/dev/sda1         76920416       1920720   71092288    3% /mnt/fire1
[root@tampa log]# mount
/dev/hda2 on / type ext3 (rw)
none on /proc type proc (rw)
usbdevfs on /proc/bus/usb type usbdevfs (rw)
/dev/hda6 on /data type ext3 (rw)
none on /dev/pts type devpts (rw,gid=5,mode=620)
/dev/hda3 on /home type ext3 (rw)
none on /dev/shm type tmpfs (rw)
/dev/scd0 on /mnt/fw-dvd type iso9660 (ro)
/dev/sda1 on /mnt/fire1 type ext3 (rw)

```

Now with the native cd-rom drive(IDE cd-r/dvd-rom in lap-top), FireWire DVD-R,-RW drive and FireWire

external drive then the mounting will go as follows:

```

[root@tampa log]# grep -i 'cd' /var/log/dmesg
hdc: HL-DT-STCD-RW/DVD-ROM GCC-4240N, ATAPI CD/DVD-ROM drive [IDE drive]
hdc: ATAPI 24X DVD-ROM CD-R/RW drive, 2048kB Cache, UDMA(33) [SCSI/FireWire drive]
Uniform CD-ROM driver Revision: 3.12
root@tampa log]# dmesg |grep -i 'sd' |more
Installing knfsd (copyright (C) 1996 okir@monad.swb.de).
Attached scsi disk sda at scsi0, channel 0, id 0, lun 0
SCSI device sda: 156355584 512-byte hdwr sectors (80054 MB)
sda: sda1
EXT3 FS 2.4-0.9.17, 10 Jan 2002 on sd(8,1), internal journal

[root@tampa root]# mount -t iso9660 -o ro /dev/hdc /mnt/cdrom | Mount cdrom

```

```
[root@tampa root]# mount -t ext3 /dev/sda1 /mnt/fire1 | Mount with specific f/s
[root@tampa root]# mount -t iso9660 -o ro /dev/scd0 /mnt/fw-dvd | Mount dvd
[root@tampa log]# df -k
Filesystem          1k-blocks      Used Available Use% Mounted on
/dev/hda2            2577424    1692388    754108   70% /
/dev/hda6            10206972    114920    9573556    2% /data
/dev/hda3            256665     86300    157112   36% /home
none                 127880      0        127880    0% /dev/shm
/dev/hdc              287466     287466      0 100% /mnt/cdrom
/dev/scd0             3942432    3942432      0 100% /mnt/fw-dvd
/dev/sda1            76920416    1920720    71092288    3% /mnt/fire1

[root@tampa log]# mount | Confirm the f/s by issuing mount command with no arguments
/dev/hda2 on / type ext3 (rw)
none on /proc type proc (rw)
usbdevfs on /proc/bus/usb type usbdevfs (rw)
/dev/hda6 on /data type ext3 (rw)
none on /dev/pts type devpts (rw,gid=5,mode=620)
/dev/hda3 on /home type ext3 (rw)
none on /dev/shm type tmpfs (rw)
/dev/hdc on /mnt/cdrom type iso9660 (ro)
/dev/scd0 on /mnt/fw-dvd type iso9660 (ro)
/dev/sda1 on /mnt/fire1 type ext3 (rw)
```

Finally, once the devices (f/s) are mounted the user can access them depending upon their access control.

For example, cd-rom will have read-only access and hard-drive will have read and write access. Once the

experiment is complete the user (or root) can unmount the device whenever it is required using the `umount`

command

```
[root@raccoon /]# umount /mnt/fw-dvd
[root@raccoon /]# umount /mnt/cdrom
[root@raccoon /]# umount /mnt/fire1
```

Trouble-shooting

If things have gone correctly you will be able to mount the devices on to a Linux workstation. Some of the frequent problems are dealt with below. If you still can't resolve the problem consult with Thayumana Somasundaram (soma@sb.fsu.edu | 850-644-6448) or Mike Zawrotny (850-644-0069 | zawrotny@sb.fsu.edu).

1) Can't umount /mnt/fw-dvd at workstation

When trying to unmount `/mnt/fw-dvd` at workstation after the use, the user (root) may encounter an error stating that the dvd is busy and the user can't unmount it. In this event, first make sure you have successfully

unexported the device from all clients. A typical session is shown below:

```
[root@neptune ~]# umount /mnt/fw-dvd
umount: /mnt/fw-dvd: device is busy
Now un export the device from other clients
[root@neptune ~]# exportfs -vu raccoon.chem.fsu.edu:/mnt/fw-dvd
unexporting raccoon.chem.fsu.edu:/mnt/fw-dvd
unexporting raccoon.chem.fsu.edu:/mnt/fw-dvd from kernel
[root@neptune ~]# umount /mnt/fw-dvd
```

2).Can't umount /mnt/fw-dvd at workstation

When trying to unmount `/mnt/fw-dvd` at workstation after the use, the user may encounter an error stating that the dvd is busy and the user can't unmount it. This may happen if the user is physically in the `/mnt/fw-dvd` or any of the subdirectories. Change directory to home and run `fuser -vu /mnt/fw-dvd` command or `lsof |grep '/mnt/fw-dvd'` and ensure no process is accessing the f/s and unmount it. A typical session is shown below:

```
[root@tampa /mnt/fw-dvd]# umount /mnt/fw-dvd
umount: /mnt/fw-dvd: device is busy
[root@tampa /mnt/fw-dvd]# fuser -vu /mnt/fw-dvd

/mnt/fw-dvd          USER      PID ACCESS COMMAND
/mnt/fw-dvd          root      kernel mount  /mnt/fw-dvd

[root@tampa /mnt/fw-dvd]# lsof |grep /mnt/fw-dvd
tcsh      2398 soma  cwd   DIR      11,0    67584    47104 /mnt/fw-dvd
rxvt      2414 soma  cwd   DIR      11,0    67584    47104 /mnt/fw-dvd
[root@tampa /mnt/fw-dvd]# cd /home
[root@tampa /mnt/fw-dvd]# kill -9 2424 or close the rxvt
[root@tampa /mnt/fw-dvd]# umount /mnt/fw-dvd
```

3). Can't see the FireWire when hotplugged

After you hot-plug a FireWire drive if you are unable to see the device there could be several reasons. Just ensure that you FireWire is powered. If it is powered and running, try unplugging and replugging it again. Even after these tries, if you don't see the device (i.e, when you list them as SCSI devices using `more /proc/scsi/scsi` or `cdrecord -scanbus` commands) the modules may not have properly been installed. To remedy this problem, uninstall and re-install the relevant modules in a set sequence. Given below is the sequence:

```
1) List the modules
[root@raccoon log]# lsmod
Module                Size  Used by    Not tainted
sg                    33924  0 (autoclean)
sr_mod                16632  0 (autoclean)
soundcore             6468   0 (autoclean)
sbp2                  19744  0 (unused)    [For Firewire]
ohci1394              18784  0 (unused)    [For Firewire]
ieee1394              45064  0 [sbp2 ohci1394] [For Firewire]

2) Remove the modules one at a time in the following sequence:
[root@raccoon log]# rmmod sbp2
[root@raccoon log]# rmmod ohci1394
[root@raccoon log]# rmmod ieee1394

3) Reinstall the modules one at a time in the following sequence (reverse of rmmod):
[root@raccoon log]# insmod ieee1394
[root@raccoon log]# insmod ohci1394
[root@raccoon log]# insmod sbp2

4) Now repeat the dvdrecord command. You will be able to see the firewire drives.
[root@raccoon ~]# more /proc/scsi/scsi
Attached devices:
Host: scsi0 Channel: 00 Id: 05 Lun: 00
Vendor: ARCHIVE Model: Python 04106-XXX Rev: 735B
Type: Sequential-Access ANSI SCSI revision: 02
```

```
Host: scsi0 Channel: 00 Id: 06 Lun: 00
  Vendor: IBM      Model: DDYS-T36950N   Rev: S80D
  Type:   Direct-Access                   ANSI SCSI revision: 03
Host: scsi1 Channel: 00 Id: 00 Lun: 00
  Vendor: HP       Model: CD-Writer+ 9500 Rev: 1.0e
  Type:   CD-ROM                               ANSI SCSI revision: 02
Host: scsi2 Channel: 00 Id: 00 Lun: 00
  Vendor: Maxtor   Model: 3000DV         Rev: 0100
  Type:   Direct-Access                   ANSI SCSI revision: 06
```