

Installing Fedora Core 6 and SKD 2.1 on the PlayStation 3

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Introduction

IBM have recently released the latest Cell SDK, version 2.1. While it can likely be installed on other distros the "default" distro is Fedora Core 6. Unfortunately the FC6 installer doesn't work properly on a PS3 so you can't just put in a disc, it's a bit more complex than that.

This article guides you through the installation and setup of both on a PS3. I also mention how to setup basic connections from another computer via SSH and VNC for good measure.

My PS3 is connected to a Standard Definition CRT TV so for much of the installation I was logged in via SSH, this saved me having to use the TV as a monitor (an almost painful experience). Once set up I then went on to set up VNC so I could use the PS3 from another system.

Note: If you just want to play around with linux on PS3 and don't need SDK 2.1 you should consider using Yellow Dog Linux, it's been built specifically for the PS3 and runs pretty well. It's reasonably fast, even over VNC. Of course other distros are also now gaining PS3 support, including Ubuntu. These are a lot simpler to install!

This article is largely based on other articles found around the web and combines them into one, the aim is to make the process easier. See References & Credits for links to the original articles.

Preparation

To start the process you will need:

- 1 PlayStation3 (duh!) running v1.6 or above of the system software (GameOS)
- 1 writeable DVD
- 1 writeable CD (or DVD)
- 1 flash memory card, USB memory key or a writeable CD
- 1 USB keyboard and mouse

An internet connection plugged into the PS3.

You're going to need to download quite a bit of data to do this:

Fedora Core 6 DVD
A DVD of Fedora Core 6 PPC (non PPC versions will not work)
There is a list of mirrors here:
<http://rhold.fedoraproject.org/Download/mirrors.html>

Follow the directories 6 -> ppc -> iso
and download this file:
FC-6-ppc-DVD.iso

Linux add-on CD
You will also need the ISO for the Linux add-on CD
<ftp://ftp.uk.linux.org/pub/linux/Sony-PS3/CELL-Linux-CL-20061110-ADDON.iso>

Note: DO NOT use any later version of the add-on ISO, it will not work with this install.
Download this file:
CELL-Linux-CL_20061208-ADDON.iso

You'll need to burn this onto a disc.

SDK 2.1
You will also need the SDK version 2.1, this can be found here:

http://www.alphaworks.ibm.com/topics/cell?open&S_TACT=105AGX16&S_CMP=DWPA

You'll need to register / login, agree to the license condition then finally download the ISO.

The Bootloader

You will also need to get hold of a bootloader.

Luckily this file can be found on the add-on CD you just burned. Look in the kboot directory and you will find a file called otheros.bld

Set up the Initial Install Medium

Setting up the PS3 is a pretty painless operation but is required no matter what OS you want to install. You'll need an install medium a Flash card, USB key or CD-ROM will do. I used a USB key.

You need create a couple of directories on the install medium and put the 2 small files in them.

First you create a directory called:
PS3

Inside this directory you create a second directory called:
otheros

Inside the otheros directory you place the bootloader: otheros.bld

You should now have:

- 1 FC6 DVD
- 1 Linux add-on CD
- 1 flash/USB/CD-ROM with the bootloader as described above.
- 1 SDK ISO

Before we begin you should make sure the PS3 has an internet connection of some form, this will not work if it doesn't as there will be a load more downloading to do. Unfortunately the wireless driver for Linux is not ready yet so the PS3 has to be physically attached to the router / gateway etc. Make sure the router / gateway firewall is on as the Linux firewall may not work (it didn't in my install).

At this point you should ensure your PS3 is running the latest version of the system software (Game OS), this install requires at least v1.6.

You are now ready to begin installing.

Installation

WARNING - this process involves reformatting your PS3 drive, this will remove any saved data you have. Only your personal settings will be preserved, everything else will be lost. You are strongly advised to do a system backup before doing this.

Formatting the system

Note: If you are installing FC6 over an existing Linux install you do not need to re-format in GameOS. The FC6 installer will do this for you. Linux formatters / installers will not however effect the GameOS partition.

In GameOS go to:

Settings -> System Settings -> Format Utility

This will give you rather limited options for formatting the HD. In my case with the 60GB HD it gave me the option of one partition with 50Gb the other with 10GB, GameOS takes one, the otheros takes the other. I decided to give Linux 10GB and leave the 50GB to GameOS.

Installing the Bootloader

To install this place the install medium with the bootloader into the PS3.

In GameOS go to:

Settings -> System Settings -> Install OtherOS

The system should automatically locate the file, follow the prompts and it should set things up for you.

Installing Fedora Core 6

In GameOS go to:
Settings -> System Settings -> Default System

Change the default system to OtherOS and opt to reboot.

The system will then reboot into a linux command line environment. This may prove a little shocking as the GameOS environment is very slick and very straight forward to use, a Linux command line looks like something out of antiquity in comparison!

If you are using a standard definition CRT TV you will also notice the command line is probably flickering like crazy, this can be reduced by playing around with the TV's contrast and brightness controls. I find turning the contrast right down helps a lot.

Once the kboot command appears you need to type in the following command:

```
install-fc sda
```

It will then ask for a DVD and at this point you should insert the FC6 DVD you burned previously.

Then type:

```
y
```

and hit enter to begin.

You will be asked if you want a full or minimal install. Make sure you pick minimal (full install fails).

The minimal install process doesn't take long and will eventually ask for the add-on CD, place it in the drive when requested and hit yes.

When the add-on CD is done it will eject itself. At this point you should place the FC6 DVD back in the drive.

[*]You may need to reboot at this point.

A manual configuration utility may appear, you can enter network settings but ignore the firewall.

If you have picked minimal you will now need to install a load of stuff manually, this will take some time but isn't difficult.

Helping your eyes with SSH

By using SSH you can log in from another system and this will not only help you eyes but also means you can just cut an paste the commands.

To get SSH installed do this:

```
mount /mnt/cdrom
cd /mnt/cdrom/Fedora/RPMS
rpm -Uvh dhclient*
cd /
dhclient
yum install openssh-server
```

Now you need to start it, this can be done with the following command:

```
service sshd start
```

You can check if it's running by typing:

```
pgrep sshd
```

If it's running it'll display the process ID of the ssh server.

You'll now need to find out the IP number of the PS3, once you've done that you can go into another computer, open a terminal and SSH into the PS3. The command you need is:

```
ssh -l root IPnumber
```

The -l root option makes sure you are logging in as root, if you don't use these your system may default to using the user you are using on the other computer, it did this with the Mac I had SSH'd from (when you switch to a user account later you'll need to change to -l root to -l your_username).

You'll be prompted for the root password and it should then log you in.

Installing Packages

You can do this from SSH or directly on the PS3 via the TV either will work, this will take quite some time to complete.

Type in the following commands exactly, alternately you can or cut and paste them from this page, answer yes to any questions:

```
yum groupinstall "KDE (K Desktop Environment)"
```

```
yum install pirut k3b mikmod
```

```
yum groupinstall "Server Configuration Tools"
```

```
yum groupinstall "Sound and Video"
```

```
yum groupinstall "GNOME Desktop Environment"
```

```
yum groupinstall "Legacy Software Support"
```

```
yum groupinstall "Development Libraries"
```

```
yum groupinstall "Development Tools"
```

```
yum groupinstall "Windows File Server"
```

```
yum groupinstall "System Tools"
```

```
yum groupinstall "X Window System"
```

```
yum install switchdesk lslk logwatch dump lftp bind-utils sendmail nss_ldap  
device-mapper-multipath ypbind yp-tools
```

```
yum install parted.ppc64 rdist.ppc man-pages.noarch talk.ppc pam_ccreds.ppc  
nc.ppc traceroute.ppc unix2dos.ppc setarch.ppc pam_passwdqc.ppc words.noarch  
cpuspeed.ppc netdump.ppc crontabs.noarch fbset.ppc acl.ppc dosfstools.ppc  
usbutils.ppc redhat-lsb.ppc rsync.ppc mgetty.ppc time.ppc man.ppc  
pam_passwdqc.ppc64 pam_smb.ppc wget.ppc
```

```
yum install diskdumputils.ppc ftp.ppc pinfo.ppc ksh.ppc jwhois.ppc psacct.ppc  
ipsec-tools.ppc dhcpv6_client.ppc lsof.ppc readahead.ppc pcmciautils.ppc  
sudo.ppc yum-updatesd.noarch pam_smb.ppc64 cyrus-sasl-plain.ppc sysreport.noarch  
pam_pkcs11.ppc64 rdate.ppc finger.ppc anacron.ppc nano.ppc pam_ccreds.ppc64  
parted.ppc attr.ppc tcsh.ppc specsno.noarch stunnel.ppc mlocate.ppc tcpdump.ppc  
dos2unix.ppc rsh.ppc irda-utils.ppc numactl.ppc tree.ppc
```

```
yum install pam_pkcs11.ppc tmpwatch.ppc gnupg.ppc vconfig.ppc iptstate.ppc  
pax.ppc mtr.ppc nss_db.ppc rp-pppoe.ppc krb5-workstation.ppc pam_krb5.ppc64  
mdadm.ppc quota.ppc pam_krb5.ppc symlinks.ppc smartmontools.ppc  
tcp_wrappers.ppc64 mtools.ppc setuptool.ppc telnet.ppc rng-utils.ppc  
irqbalance.ppc
```

```
yum groupinstall "Office/Productivity"
```

```
yum install netpbm netpbm-devel tk-8.4.*
```

```
yum install --enablerepo=extras freeglut freeglut-devel mesa-libGLU-devel mesa-  
libGL-devel libX11-devel libXmu-devel libXext-devel
```

Editing Files

Most stuff will now be installed but the system will remain firmly in text mode. To change this you need to modify a few files.

First we'll change the setup so it boots into graphics mode. To do this well use the editor vi, personally I don't like vi one little bit but it's always around and works. It was originally written 30 years ago hence the weird command modes.

If anything in vi goes wrong hit esc then type:

```
:q!
```

That quits vi without saving changes.

The first file to change is the xorg config file, type:

```
cd /etc/X11/  
vi xorg.conf
```

Scroll down to the section named "Device" and press i
Pressing i puts you into insert (i.e. edit) mode.
Change the section so it reads as follows:

```
Identifier "Videocard0"  
Driver "fbdev"  
  
Option "ShadowFB" "false"  
# Option "UseFBDev" "true"
```

Once you've done that press esc. This will put you into command mode.
type:

```
:wq
```

This will save the file and exit vi.

Now you want to change the /etc/inittab file, type:

```
cd /etc/  
vi inittab
```

You will find a line something like:
id:3:initdefault

Enter command mode with i and change it to:

```
id:5:initdefault
```

Save and quit with:

```
esc  
:wq
```

Videomode

The file to change selects the videomode the PS3 boots into. You must select a mode your TV can handle or you wont be able to see anything. Happily If you get this wrong you can always SSH in and change it and try again.

To see your existing video mode just type:
`ps3videomode`

To see a list of available modes type:
`ps3videomode -h`

If you are using an "HDRReady" TV all the modes should be useable. If the TV can't display the mode natively it will scale the image accordingly.

If you are using a SD TV you'll be stuck with mode 6 (PAL) or 1 (NTSC) in the US / Japan.

You want to ensure the system boots into the right mode so you can set it up properly, to do this you need to edit another file. Type:

```
cd /etc
vi kboot.conf
```

Replace the contents of the file with this:

```
default=linux
timeout=10
root=LABEL=/

linux='/boot/vmlinuz-2.6.16 initrd=/boot/initrd.img video=ps3fb:mode:6'
fc576i='/boot/vmlinuz-2.6.16 initrd=/boot/initrd.img video=ps3fb:mode:6'
fc480i='/boot/vmlinuz-2.6.16 initrd=/boot/initrd.img video=ps3fb:mode:1'
fc576p='/boot/vmlinuz-2.6.16 initrd=/boot/initrd.img video=ps3fb:mode:7'
fc480p='/boot/vmlinuz-2.6.16 initrd=/boot/initrd.img video=ps3fb:mode:1'
fc720p='/boot/vmlinuz-2.6.16 initrd=/boot/initrd.img video=ps3fb:mode:3'
fc1080i='/boot/vmlinuz-2.6.16 initrd=/boot/initrd.img video=ps3fb:mode:4'
fc1080p='/boot/vmlinuz-2.6.16 initrd=/boot/initrd.img video=ps3fb:mode:5'
text='/boot/vmlinuz-2.6.16 initrd=/boot/initrd.img 3'
singleuser='/boot/vmlinuz-2.6.16 initrd=/boot/initrd.img single'
```

This will default to the mode numbered at the end of the line starting with "linux" I have it set to 6 here but if you want another mode just change the number.

The other options are available when the system boots, when "kboot" appears pressing TAB allows you to go through the different options.

Press i

Change the number to a mode number your TV will accept, if you don't know select 6 (1 in the US) as every TV will accept these.

press ecs for command mode then

:wq

to save and quit.

Gnome and KDE

You should now be ready to boot into a GUI, eject the DVD then you need to reboot.

To reboot from the command line type:

```
shutdown -r now
```

Note: If you just want to shut down change the -r to a -h.

The system should boot up and get to a kboot prompt, you can either just wait or press enter. The system should then boot up with a nice graphical login screen.

To select the desktop you want press session. The default is Gnome but if you prefer KDE that is a also an option.

Note: I had a lot of problems using KDE over VNC, it crashed - a lot - and at one point took out my entire file system. I've since switched to Gnome and have no problems to report.

Setup Networking

In KDE goto System->Administration->Network

Add a new device

Select Ethernet connection and press forward.

Select the driver with "(eth0)" and press forward.

Unless you have specific settings set the network to dhcp.

Once it's added select "activate".

If you plan to use VNC having the system on dhcp could be problematic as the PS3's IP can change. it is best in this case to set the IP address manually, to do this you will need to know the subnet mask, default gateway address and DNS settings for your network. You will then need to pick a free IP address on the network and add the PS3 there.

Setup VNC

If you have a PS3 connected to a Standard Definition TV it'll only be capable of low resolution and the Linux desktops don't appear to be capable of shrinking to this size. What you can do however is use the PS3 via VNC from a different computer.

This is far from ideal as VNC can be painfully slow but it is a useable solution provided you don't try playing around with fancy graphics.

VNC is easy to setup in KDE, all you need to do is:

Bring up KDE Control Centre

Select Internet & Network -> Desktop Sharing

Select:

Allow uninvited connections

Allow uninvited connections to control the desktop.

Add a password.

Now select the Network tab.

Make sure "Assign port automatically" is not selected.

Select a port, 5900 or 5901 seems to be the standard ports.

You'll need to enter the details into a VNC client including:

IP number

Port

password

I use CotVNC on a Mac, it doesn't have a place to put in the port so you append it to the IP number.

It'll look something like this:

```
192.168.1.10:5901
```

You will also be able to select the number of colours used. This is important because you can speed up the display quite considerably.

Setting the VNC client to 16 bit graphics will speed things up somewhat, setting it to 8bit is even faster but the display tends to be hideously ugly. Messing around with the theme settings can make it rather less ugly.

VNC goes like a greased snail, it's slow and any speedup is appreciated. Unfortunately the KDE VNC server seems to be particularly slow, the one standard in YellowDog Linux appears to be a lot faster.

OK, now test it.

Your VNC client should be able to get into the desktop and control it.

Once you've done this you will thankfully no longer need to use the TV to control the PS3.

You can set the PS3 to bootup into a higher resolution video mode but be aware that the login screen is displayed in this mode. Because of this you will have to login blind, this is pretty easy though as all you need to do is type in the user name and press enter, then type in the password and press enter. You'll be able to tell if it works because the HD becomes active loading KDE.

If you have a problem just go in via SSH, reset the screen mode and reboot. You can then mess around with the KDE (or Gnome) settings.

If you want to go back to GameOS, e.g. to watch Casino Royale (it just arrived) or play Super Rub 'a' Dub the procedure is very easy:

Shutdown the machine

Put your finger on the on switch but hold until you hear a second 2 beep (takes 5-10 seconds), the PS3 will now boot into GameOS.

To go back into Linux go into:

Settings -> System Settings -> Default System

Set the default to Other OS.

Preparing to Install SDK 2.1

You should have already downloaded the SDK ISO from IBM here:

http://www.alphaworks.ibm.com/topics/cell?open&S_TACT=105AGX16&S_CMP=DWPA

If not register and download it.

Once you've downloaded it you'll need to put it onto some install media, I just put it on a USB key drive. You don't need to burn it to a disk but that's up to you.

The SDK install involves installing a whole heap of other data which is not on the CD so you'll need to have an wired internet connection, wired because there are no wireless Linux drivers for the PS3 yet.

Be very careful however as the firewall in FC6 appears to broken on the PS3, it fails on startup and reinstalling it had no effect.

Before you start the install you'll need to install a library, type:

```
yum install numactl-devel
```

That will download and install the required library, you are then ready to begin.

Installing the SDK

Installing the SDK is easy but can be quite time consuming.

First CD to the directory where the ISO is. Then type:

```
mkdir -p /mnt/cellsdk  
mount -o loop CellSDK21.iso /mnt/cellsdk  
cd /mnt/cellsdk/software
```

Installation is done with the install command, however as standard it will install everything including the simulator. You have a choice of commands if you do or do not want the simulator, the sim is useful but it includes an image file which is 1.8GB, if you have 10GB allocated to linux that's going to eat a significant chunk of your HD space so you may choose to miss it.

To install with the simulator type:

```
./cellsdk install
```

To install without the simulator type:

```
./cellsdk install --nosim
```

It will keep asking questions, just answer yes.

Once it's downloaded everything it needs it'll start installing itself. If your download was stalled or otherwise went wrong it may go haywire and stop.

You can continue by issuing the same command again.

If you get an error in an rpm (they seem to be quite common, I had a few) you'll need to delete the rpm/s and restart.

The rpms are stored in /tmp/cellsdk-2.1 while they are being installed, if one is bad you can delete it from there. Re-issue the install command and it should then work.

Building the libraries

The libraries you will use do not come as binaries but need to be built. This is done with a script but does take some considerable time. You can build them using the xlc compiler or the standard gcc, the default is gcc.

Type:

```
cd /opt/ibm/cell-sdk/prototype
```

If you wish to build with xlc type:

```
./cellsdk build --xlc
```

If you wish to build with gcc type:

```
./cellsdk build --gcc
```

Now go order a pizza or something, you've plenty of time...

Once it's done that's it. To clean up type:

```
cd /  
umount /mnt/cellsdk
```

Starting Coding & Documentation

To get anywhere you'll need to read over the docs, if you don't you'll only end up getting very confused. It is pretty essential to understand Cell before you'll get good performance out of it. It is quite different from a traditional processor and while normal code will work it won't get close to the Cell's potential. Actual programming doesn't appear to be terribly difficult astonishing speedups can and have been achieved in days by first time Cell developers. Understanding how Cell works appears to be the problem some people have problems getting their head around. Make sure you understand this.

The docs can be found on the Cell SDK ISO image (I've no idea why they don't install these on PS3).

The first place to look is at:
`/html/index.html`

This links to all the files present.

There's lots to read but you'll especially want to look at:
Cell Broadband Engine Programming Tutorial V2.1

Worth Noting:

1) If you follow examples written for Yellow Dog you'll probably run into some problems due to differences between the systems.

You will need the command `embedspu` at some point, this does exist on FC6 but just to confuse you it has a slightly different name.

In FC6 you'll find the instructions have "ppu-" or "spu-" in front of them.

In place of `embedspu` use:

`ppu32-embedspu`

2) If you are having linking problems add
`-lm`

(a small L, not a big i) into your compile command, that should fix it.

3) Eclipse will not work out of the box, see the instructions on the SDK ISO.

Conclusion

You should now have a working FC6 / SDK 2.1 installation.

I'd like to see a Fedora Core built specifically for PS3, I get the distinct impression it could be faster. Yellow Dog also uses Enlightenment as it's default desktop, it's more basic than the likes of KDE and I had a few issues with it but it is faster over VNC. The PS3 has the potential to be a useful desktop but it's currently held back by software.

Hopefully Fedora Core 7 should be a lot simpler to install, looks like someone is working on it:

<http://fedoraproject.org/wiki/PlayStation>

Have fun...

[*] Note: Reboots and configuration utility

I don't remember exactly when I rebooted the system and when the manual configuration utility appeared. If anyone finds out please let me know.

References & Credits:

This article is based on the following other articles:

Installing Fedora Core 6 on PS3

<http://forums.qj.net/f-ps3-linux-283/t-how-to-install-fedora-core-6-linux-for-ps3-88431.html>

Installing Fedora Core 5 on PS3

http://linuxps3.net/index.php?option=com_content&task=view&id=33&Itemid=32

Cross compiling for PS3 Linux

http://www.cellperformance.com/articles/2006/11/crosscompiling_for_ps3_linux.html

Cell SDK:

How to get started (in Cell SDK)

CBE Tutorial (in Cell SDK)

Sony Openplatform Site:

<http://www.playstation.com/ps3-openplatform/index.html>

Miscellaneous VNC, VI & SSH howtos.