

## Dual head: two monitors on one computer

# DOUBLE VISION

From version 4, XFree86 has allowed several graphics cards to be used at the same time; so another older PCI card can be added onto the AGP card in the computer in order to drive a second monitor. An similar arrangement can be achieved using a dual head graphics card with two monitor ports.

In this article we describe how you can run two monitors in parallel with two graphics cards, or one dual head card (with two VGA outputs). To be able to use this feature, you must already be working with XFree86 4.x – we did our tests with the latest version; 4.1.0. XFree86 3.x cannot handle dual head operation.

### Installing two cards

After installing an additional PCI card you first need to find out in what sequence the computer deals with these. This is easy: connect the two monitors and start the computer; the card displaying the BIOS messages is the “first”. If you don’t like the order, as well as swapping the monitors around you may also have the option of setting the bus sequence in the BIOS (AGP/PCI or PCI/AGP).

Now start to run Linux at a run level in which X is not activated; in Red Hat and Mandrake, run level 3 is appropriate, whilst for SuSE run level 2 is the one you need. A few distributions will recognise the new graphics card when the system starts and will automatically integrate it (Mandrake Linux 8, for example, immediately proposed a configuration with both cards). We will do it ourselves below.

After logging on as root, first check whether both cards have been correctly recognised by Linux. To do this, search for graphics cards with *lspci*. In our example computer, with a Matrox G400 and an ATI Rage PCI card, it looks like this:

```
[Test@dual dual]$ lspci | grep VGA
00:0a.0 VGA compatible controller: ATI
Technologies Inc 3D Rage IIC 215IIC [Mach64 GT
IIC] (rev 3a)
01:00.0 VGA compatible controller: Matrox
Graphics, Inc. MGA G400 AGP (rev 04)
```

The output reveals two things: firstly, both graphics cards were recognised by the kernel, and secondly we learn for each card, in the form “xx:yy.z”, how it



Two desktops from one machine. Both have a KDE panel but only one has desktop icons

can be addressed. xx in this case is the bus ID (00 is the PCI bus, 01 the AGP bus); yy is the device ID (in hexadecimal notation – 0a is 10 in the decimal system); and z is the “function”, usually 0. We will now need these figures to describe the cards in the XFree86 configuration. To find out this information, *lspci* interrogates PCI and AGP bus and looks up the device IDs in the file */usr/share/pci.ids*.

Now create a backup copy of the XFree86 configuration file (often called */etc/X11/XF86Config-4*, to differentiate it from the corresponding file for XFree 3.x), and open this in an editor of your choice. Look for the Device section. If X was correctly installed before the addition of the second graphics card, then the AGP card should already be configured. Since we will want to use two cards from here on in, in the first instance we should complete a “Bus ID” entry, which receives the value for the AGP card “PCI:1:0:0”. This specification corresponds to the *lspci* output “01:00.0”.

```
# Graphics device section
Section "Device"
    Identifier "Matrox Millennium G400"
    VendorName "Matrox"
    BoardName "Millennium G400"
    Driver "mga"
    Option "DPMS"
    BusID "PCI:1:0:0"
EndSection
```

From version 4, Xfree86 has allowed several graphics cards to be used at once; enabling even those without dual head graphics cards to run multiple monitors. Hans-Georg Esser looks at the pros and pitfalls of dual displays

Under this device section, add a second entry; in our case we are configuring an ATI card. The device section looks almost exactly as would be the case if this was the only card present – here again we specify the Bus ID: “00:0a:0” (from *lspci*), which now becomes “PCI:0:10:0”.

```
Section "Device"
    Identifier "ATI Mach64 3D RAGE II"
    VendorName "ATI"
    BoardName "Rage II"
    Driver "ati"
    Option "DPMS"
    BusID "PCI:0:10:0"
EndSection
```

As the next step, we must define the two monitors to be connected to the cards. The only unusual thing here is that there are two “Monitor” sections:

```
# Monitor section
Section "Monitor"
    Identifier "monitor1"
    VendorName "Unknown"
    ModelName "Unknown"
    HorizSync 30-96
    VertRefresh 48-120
EndSection

Section "Monitor"
    Identifier "monitor2"
    VendorName "Unknown"
    ModelName "Unknown"
    HorizSync 30-96
    VertRefresh 48-120
EndSection
```

Monitor1 should in this case be the left-hand monitor; monitor2, the right. Next comes the definition of the two screen sections. A screen consists of a combination consisting of “Device” and “Monitor” and the settings for resolution and colour depth. These sections also look quite normal:

```
# Screen sections
Section "Screen"
    Identifier "left"
    Device "Matrox Millennium G400"
    Monitor "monitor1"
    DefaultColorDepth 16
    Subsection "Display"
        Depth 16
        Modes "1280x1024" "1024x768" "800x600"
        "640x480"
        ViewPort 0 0
    EndSubsection
EndSection

Section "Screen"
    Identifier "right"
```

```
Device "ATI Mach64 3D RAGE II"
Monitor "monitor2"
DefaultColorDepth 16
Subsection "Display"
    Depth 16
    Modes "1024x768" "800x600" "640x480"
    ViewPort 0 0
EndSubsection
EndSection
```

To offer more clarity we have provided the two “Screen” sections with the identifiers “left” and “right”. The maximum resolutions of the two screens are different in this case: the left display will start at 1280x1024, while the right display offers only 1024x768 pixels.

Finally, the X-Server still has to be told which screens are used in which layout – this is done via a Server Layout section:

```
# Server Layout
Section "ServerLayout"
    Identifier "layout1"
    Screen "left"
    Screen "right" RightOf "left"
    InputDevice "Mouse1" "CorePointer"
    InputDevice "Keyboard1" "CoreKeyboard"
EndSection
```

The keyword “RightOf” does exactly what it says: the right screen is arranged on the right of the left one. We have not listed all the other sections of the X configuration file here – obviously mouse, keyboard and fonts modules need to be configured, but this is done in exactly the same way as you would for a single card.

## Xinerama

There are two different options available to you when using multiple monitors. One of these is called Xinerama, which creates a large common desktop on which windows can be moved back and forth between the two monitors; at the same time one window can lie on the edge so that a part of it shows in each of the two displays.

The Xinerama option is only worth pursuing if both of your monitors run at the same resolution. Since a desktop is always rectangular, if there are two different resolutions the smaller display (in the case of the left-right arrangement) will be treated as if it has the same number of lines and the larger one. As a result, part of the desktop (a half line in the right-hand area, for example) will not be visible. In KDE and GNOME this affects the start menu, which is located by default on the bottom edge of the desktop, so that this cannot be made out on the smaller monitor.

If both monitors are used at the same resolution then there’s no reason not to use Xinerama. The

ServerLayout section should then be supplemented by one extra option:

```
# Server Layout
Section "ServerLayout"
    Identifier "layout1"
    Screen "left"
    Screen "right" RightOf "left"
    Option "Xinerama" "on"
    InputDevice "Mouse1" "CorePointer"
    InputDevice "Keyboard1" "CoreKeyboard"
EndSection
```

Those who waive the Xinerama option will instead get a separate desktop on each of the two monitors. KDE 2.2 then also creates an additional KDE directory *Desktop1* in the home directory for *Desktop*. This houses the icon placements for your second desktop. In addition to the desktop configuration file, *kdesktoprc*, a second file called *kdesktop-screen-1rc* is also created in *.kde/share/config*. This ensures that both desktops are installed completely separately. The second desktop also offers a separate start menu.

One small bug in this setup came to light when activating the screensaver: although both desktops are barred to inputs until the password is entered, the second desktop remains in view. Therefore, if you want to stop nosy people seeing the window of the second monitor, you should first minimise this or else switch to a clear desktop.

## Displays :0.0 and :0.1

The `$DISPLAY` variable under X provides information about the X-Server on which an application is being displayed. This is normally `":0.0"`. With two separate desktops, two X-displays can also now be activated – these are called `":0.0"` and `":0.1"`. To check that this is correct, simply open a terminal program on each of the two desktops and enter the command

```
echo $DISPLAY
```

If you now specifically want to open a window on the left or right desktop, you can use the standard X option `"-display"`:

```
xterm -display :0.0
```

will make an *xterm* appear on the left monitor, while with `":0.1"` instead of `":0.0"` the right monitor will be activated.

## Dual head cards

As an alternative to using two graphics cards you can also use a dual head card: these contain two graphics chips and accordingly, two monitor ports – effectively saving you one slot. We tried this out feature using the Matrox Millennium G400.

The X-configuration here runs in a similar way to

the case of two graphics cards: here two "Device", "Monitor" and "Screen" sections will also be needed. There is just one difference in the "Device" inputs, because the same graphics card has to be addressed twice. There is also the additional keyword "Screen", by which the two VGA outputs of the card are distinguished. Appropriate "Device" sections look like this:

```
Section "Device"
    Identifier "G400_1"
    Driver "mga"
    BusID "PCI:1:0:0"
    Screen 0
EndSection

Section "Device"
    Identifier "G400_2"
    Driver "mga"
    BusID "PCI:1:0:0"
    Screen 1
EndSection
```

For this card there are modules and configuration tools on the Matrox FTP server, which must be installed; the two archives are called *mga-133\_143.tgz* and *mgapdesk-1\_00-7beta\_i386.rpm*. The first contains the modules *mga\_drv.o*, *mga\_hal\_drv.o* and *mga\_dri.so* (for XFree86 4.1.0 and 4.0.3). These replace (and supplement) the module *mga\_drv.o*, which is an integral part of XFree86. In the test this worked really well, although with one problematic limitation: if one changes to a text console (via `Ctrl+Alt+F1`, for example) and then back to X, the computer hangs completely and has to be restarted. This is obviously liable to lead to data loss so should be avoided... This problem arose under both XFree86 4.0.2 and 4.1.0 (with the respective Matrox drivers).

## Easy and effective

Anyone who has an old PCI graphics card and a monitor to spare can quickly double their Linux desktop with XFree86 4.x: Unlike the virtual desktops provided by KDE and GNOME, a dual display has the advantage of being able to show two-fold content at the same time. Whether for software development, excessive Web consumption with lots of open Netscape windows or simply to display the television picture on the second monitor: with two desktops, work is twice as much fun. Best of luck with the configuration.

**Hexadecimal** The hexadecimal number system, unlike our normal decimal system, possesses 16 numbers: 0-9 and the letters a to f, representing 10 to 15. A hexadecimal number, such as "01f3", will be converted as  $0 * 16^3 + 1 * 16^2 + 15 * 16^1 + 3 * 16^0 = 499$  in the decimal system.