9.1.4 Viewing Hardware Information

Click one of the buttons to take you to that part of the video.

Viewing Hardware Information 0:00-0:26

In this demonstration we're going to talk about viewing hardware information on a Linux system. There are two different ways that you can do this, and we're going to look at both of these in this demo. First, you can view the content of files that store hardware information or you can run utilities from the shell prompt to view hardware information.

Let's begin by reviewing several files that you can access to view information about the hardware in your Linux system.

/proc Directory 0:27-2:32

First, I need to switch to my root user account. The first place we need to look is the /proc directory. /proc is not a real directory. It's actually a virtual directory that's dynamically created whenever you access it, such as we just did here.

I'm going to run the 'ls' command here so we can view all the information within this directory. There are two different types of information stored in /proc. The first is process-related information. Whenever you load a process on a Linux system, a corresponding subdirectory is created in /proc and it's named using the process ID number of that process.

If you go into any of these subdirectories you'll see information about that running process. However, for our purposes today we want to focus on these files over here. These files contain hardware information. These files are just text files, so you can view them with any of the text utilities that we've talked about, such as cat, less, tail, and so on.

For example, there's a file here called 'cpuinfo'. 'cpuinfo' contains information about the processor installed in this system. To view it we can just type 'less cpuinfo'. I will point out that most of these files are fairly long, so instead of using 'cat' it's usually a lot better to use 'less'. Or if you do use 'cat', type the output to 'more'.

Here you can see information about the processor in the system. It's a genuine Intel processor. It's a Pentium D running at 2.8 gigahertz. Here's the size of its cache and so on. There's another file in here called 'devices'. It just contains a list of all the hardware devices that are configured in the system. There's another file called DMA which contains a list of DMA assignments.

The DMA file contains a list of DMA channel assignments, and right now you can see there's just one: DMA channel 4. It's actually not really a channel assignment, because it's just being used for cascading.

'interrupts' File / iomem and ioports 2:33-3:54

A more useful file will probably be the 'interrupts' file. If we want to see what harbored devices are using which interrupts in the system, we can look at this file.

For example, we can see that we have a parallel port here that's using interrupt 7. We have two ATA controllers. These are old ID controllers that are using interrupts 14 and 15. In addition to interrupts, you can also view information about the I/O port on the system. There's actually two files we need to look at for I/O port information. One is iomem and the other is ioports.

Let's look at iomem first. iomem simply lists the memory reservations that have been defined for are ioports, and you can see those here. If we look at the ioports file we can see which hardware devices have been assigned which IO port. There's another useful file in this directory called 'meminfo'. meminfo contains memory utilization statistics. For example, we can see the total amount of memory in the system, about 2 GB. We can see how much memory is available. We can see how much memory has been cached.

We can see how much swap memory, or virtual memory, is available and how much has been used.

'modules' File 3:55-4:49

Another useful file is the 'modules' file. The modules file contains a list of all the kernel modules loaded on the system. Remember, with Linux when we talk about kernel modules we're talking essentially about drivers. They provide the interface between the physical hardware in the system and the CPU in the operating system.

Let's do 'less modules'. You can see a list of all the kernel modules that have currently been loaded. You can also view version information about the operating system. This is contained in the version file, 'cat version'. Here you can view Linux version number information. You probably notice that this is very similar to the output that you see when you run the 'uname' command.

You can also view how long the system has been up and running by viewing the 'uptime' file. Here it tells us how long the system has been up. Do an 'ls' command here.

SCSI Devices 4:50-6:48

There's a subdirectory in /proc that contains useful hardware information about the SCSI devices installed in our system. Remember when we're dealing with Linux, if you have a SATA drive connected to the system or a USB drive connected to the system, the Linux kernel views those devices as SCSI devices.

To view the information about the storage devices in most Linux systems, this is the directory where you need to go. Let's go into scsi. We do an 'ls' command. One useful file here is the 'scsi' file. In here you can see a list of all the SCSI devices that have been installed in the system. These actually aren't really SCSI devices as I said earlier. They're actually SATA devices.

If we look at the output we see that we have one optical drive, two hard disks and also a USB drive connected to this system. This system is actually running in VMware virtual machine, so for these first three devices the vendor is VMware, and the model basically are virtual disks indicating that these aren't really hardware devices. They are virtual devices. This USB drive down here is actually a physical thumb drive that's been connected into the system and accessed by the virtual machine.

The vendor is Kingston. The model is Data Traveler 2.0. Let's go up a level and do the 'ls' command. Other useful hardware information is contained in this directory right here, the bus directory. Let's go into it. Within this directory are two subdirectories. One is input, one is pci. If we wanted to view information about the input devices connected to this system, we'd go into the input directory. Notice in here there's a file called 'devices'. Within this file we see information about the various input devices connected to the system, such as our keyboard and our mouse.

In addition to the /proc directory, there's also another directory that's very useful called the /sys directory.

/sys Directory 6:49-7:25

Let's going into /sys. /sys is just like /proc in many ways. It's also a virtual directory that is dynamically created whenever you access it. It's not actually physically stored on the hard disk drive.

Like /proc, it also contains hardware information; unlike /proc, the /sys directory organizes hardware information in kind of a tree structure. From the 'ls' command we'll see what is here. For example we have the /block directory. /block contains an entry for every block device that's been discovered on the system. Basically, these are all the storage devices that have been discovered on the system.

/bus Directory 7:26-9:12

We also have the /bus directory. /bus contains a subdirectory for every bus that's been implemented on the motherboard. Let's go into /bus so we can see that. Run the 'ls' command. For example, we have the PCI bus, SCSI bus, USB bus, memory bus, and so on. Let's go into the PCI directory to view information about devices on the PCI bus.

In each of these subdirectories of the /bus directory you'll find two other subdirectories. One is named 'devices' and the other is named 'drivers'. 'devices' contains entries for each device that's been discovered on that bus, so in this case we would see entries for every PCI device that's installed in the system. Then the /drivers directory contains a list of drivers that are used to support those devices.

Let's go back up to the /sys directory. We also have a directory here called /devices. Let's go into that directory now. /devices is interesting because it contains, essentially, a global device hierarchy. Each hardware device that's been discovered on the system is represented in one of these subdirectories here.

Each device will be shown as a subordinate device to the device that it is physically connected to in the system. Go back up to /sys. Another useful directory here is the /module directory. The module directory contains a subdirectory for each kernel module, or each hardware driver if you will, that's been loaded on the system.

'ls usb' Command 9:13-10:32

At this point we need to shift gears a little bit and look at several of the command line utilities that you can use to view hardware information on your system. I'm going to 'clear' this so we have a clean screen. One of them is the 'ls usb' command. That's a very useful command. It displays information about all of the USB devices that are currently connected to the system.

Let's go ahead and run it. Here you can see a listing of all the USB devices in the system. I have some root hubs. I have a root hub here. I have a root hub here. I have a mouse and I also have my USB thumb drive right here. If you look at the bus column over here you can see that I have two USB buses, bus1 and bus2.

On bus1 the first device is the root hub, which is what it should be. The second device is the thumb drive. On bus2 I have a root hub, but I also have an additional USB hub connected to that hub. I also have my mouse connected. Over here in this third column you can see this device number. On bus1, the first device is the hub of course and the second device is the thumb drive. On bus2 the first device is the root hub as it should be, then I have my mouse connected to that hub. Then I also have an additional virtual USB hub connected to the root hub as well.

'hw info' Command 10:33-10:56

Some distributions also include a command called 'hw info', which as you might guess stands for hardware info. It will probe the hardware in the system and then generate and overview report. I actually really like the 'hw info' command. I use it all the time. Unfortunately, it's not included on all distributions, and I'm pretty sure it's not included on this Fedora distribution--and it's not.

Other distributions, such as openSUSE, do include this command.

'lspci' Command 10:57-11:58

The last command we're going to look at is the 'lspci' command. The 'lspci' command, as its name implies, lists all of the PCI devices that are currently installed in the system. The output is quite long, so let's pipe the output to the 'more' command. When we do, we can see all of the PCI devices that have been installed in the system, such as our IDE interface, our video adapter.

Go to the bottom. We can see our USB controllers and we can see SCSI controller and our Ethernet controller. There's a useful option you can use with the 'lspci' command. That's the '-k' option. What it will do is display not only all the devices that are connected to the PCI bus, but then also each of the kernel modules that are used to support those devices.

For example, here you can see information about the video adapter that's installed in the system. Here you can see the kernel modules that have been loaded to support that hardware device.

Summary 11:59-12:14

That's it for this demonstration. In this demo we talked about viewing hardware information in a Linux system. We first looked at hardware information in the /proc directory, then we looked at hardware information in the /sys directory. Then we looked at several commands you can run from the command line to view hardware information, such as 'ls usb', 'hw info', and 'lspci'.

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