9.1.5 Device Driver Facts

This lesson covers the following topics:

- Implementing device drivers
- Driver information
- Linux driver utilities

Implementing Device Drivers

A device driver is a software component that allows a hardware device to communicate with the operating system of a computer. Drivers allow an operating system to correctly interpret and implement the signals that come from the hardware device. The following table describes the two methods Linux uses to implement device drivers:

Method	Description
Loaded as a kernel module	A kernel *module* is software that the kernel accesses only when it is needed. When in use, modules run as if they were part of the kernel and have the same access rights. Modules: - Have an .o or .ko extension. - Are stored in the **/lib/modules/***kernel_version***/kernel/drivers/***driver_name* directory. - Are linked and unlinked dynamically.
Compiled into the kernel	When the drivers are compiled into the kernel, they are integrated into the kernel build when the kernel is recompiled. This method requires an administrator to recompile the kernel. Drivers compiled into the kernel: - Increase the size and complexity of the kernel. - Require considerable configuration expertise. - Consume additional computer resources. - Should be limited to the hardware needed to boot the computer, such as drivers for the keyboard, mouse, and disk drive.

Driver Information

The following directories contain information about the hardware that is installed on the computer:

Directory	Contents
/proc	The **/proc** directory contains information about the system state and processes. Its contents are created dynamically. Files and directories found in the **/proc** directory are: - **cmdline** contains the boot options that were given to the kernel at boot time. - **cpuinfo** contains information about the computer's CPU. - **devices** contains a list of hardware installed on the computer. - **dma** contains all the direct memory access assignments for the computer. Direct memory access gives hardware devices direct access to the computer's memory independent of the CPU. - **interrupts** lists the interrupt request (IRQ) channels the computer uses. Interrupt requests are signals sent to the CPU that inform it that it needs to process input from a hardware device. - **iomem** contains a mapping of the memory allocated to each device and the input/output port assignments for the memory. - **modules** lists the kernel modules that the computer is currently using. - **version** gives information about the current kernel version. - **meminfo** displays detailed memory information on the system. - **/scsi** contains a file or directory for each SCSI device attached to the computer. - **/bus** contains a file or directory for each USB device attached to the computer. - **/ide** contains a file for the IDE devices attached to the computer, including the internal hard drives and other devices that attach to an IDE ribbon. Be aware of the following facts about the files within **/proc**: - Use the **cat** command (or other text viewing utilities) to view files in the **/proc** directory and subdirectories. - Do not use **vi** to view or modify files in the **/proc** directory. Instead, use the **echo** command to redirect commands to the appropriate files or commands.
/sys	The **/sys** directory displays information about devices and drivers. The following directories are found in the **/sys** directory: - **/block** has an entry for each block device on the computer. Block devices include flash drives and hard disk drives. - **/bus** holds a subdirectory for SCSI, USB, PCI, and ISA devices. Each of these subdirectories has an additional directory for devices and drivers that has information for each device and driver in the category. - **/class** has files for each class of devices on the computer.

	▪ **/devices** lists every device that has been discovered on the computer. The directory hierarchy places each device beneath the device to which it is connected. ▪ **/module** has a subdirectory for each kernel module installed on the computer.

Linux Driver Utilities

Linux includes several utilities that provide extensive information about your hardware configuration, including:

Command	Function	Examples
lsusb	Displays information on all USB devices connected to the computer. This utility uses the following options: ▪ **-v** shows exhaustive information. ▪ **-s** *bus_name* shows information for a specific bus. ▪ **-t** displays the USB device hierarchy as a tree.	**lsusb -v** shows all information about each USB device on the computer.
hwinfo	Displays information about hardware on the computer. Be aware of the following options: ▪ ***--hardware_item_name*** probes for a specific hardware item. Common hardware names include: ▪ **bluetooth** ▪ **camera** ▪ **cdrom** ▪ **cpu** ▪ **disk** ▪ **dsl** ▪ **monitor** ▪ **mouse** ▪ **keyboard** ▪ **usb** ▪ **--short** shows an abbreviated list of information. ▪ **--listmd** displays RAID devices. Not all distributions include the hwinfo command.	**hwinfo --cpu** shows information about the computer's CPU.
lspci	Displays information for all PCI devices. Be aware of the following options: ▪ **-k** shows the kernel drivers that support the device. ▪ **-t** displays a tree diagram that shows connections between all busses, bridges, and devices.	**lspci -k** shows the devices and the kernel drivers that support them.
lsdev	Gathers information about your computer's installed hardware from the interrupts, ioports, and dma files in the **/proc** directory. This gives you a quick overview of which hardware uses what I/O addresses and what IRQ and DMA channels. There are no options for this utility. Not all distributions include the hwinfo command.	