*/proc* is a virtual file system which only occupies the memory space.

*# cat /proc/partitions:* check the disk name.

*# cat /proc/interrupts*: tell you the devices and their relative IRQ number and how many of each there has been. You can check if a specified interrupt working properly, and count the times of interrupts which are triggered. After you insert the modules, you can see the interrupt name you register by calling *request\_irq()*. While AP is running to call the driver, you can see the times of interrupt are increasing.

# [How to open a new terminal](http://ubuntuforums.org/showthread.php?t=1655194)

*system("xterm -e yourchatprogram&");*

Actually *system()* calls *fork()* and *exec()*. If you call *exec()* with "*xterm*" "*-e*" and "*yourchatprogram*", it will open a new terminal. *system()* actually calls *fork()* and *exec()* *twice* because the command is executed through */bin/sh*. So calling *fork()* and *exec()* and then *system()* is redundant, instead you could use just *system()* with hakermania's command "*xterm -e yourchatprogram &*". Or, even better, just fork then

*char \* cmd[] = {"/usr/bin/xterm", "-e", "yourchatprogram", NULL};*

*execv(cmd[0], cmd);*

xterm is available on every version of linux, other terminals like gnome-terminal may not be available.

# [how to store the output of system() call?](http://stackoverflow.com/questions/5549448/how-to-store-the-output-of-system-call)

*system()* spawns a new shell process that isn't connected to the parent through a pipe or something else. It’s required to use *popen()* instead. Then read the output and push each string into your array as you encounter newline characters.

*FILE \*fp = popen("ps aux | grep ‘python testlet.py’ | grep –v grep", "r");*

*char buf[1024];*

*while (fgets(buf, 1024, fp)) {/\* do something with buf \*/}*

*fclose(fp);*

Linux核心固定週期會發出timer interrupt (IRQ 0)，HZ定義每秒幾次timer interrupts。HZ可在編譯核心時設定：  
*$ make menuconfig  
Processor type and features ---> Timer frequency (250 HZ) --->*

其中HZ可設定100、250、300或1000。觀察*/proc/interrupt*的timer中斷次數，並於一秒後再次觀察其值。理論上兩者應該相差250左右。Tick是HZ的倒數，意即timer interrupt每發生一次中斷的時間。

*$ cat /proc/interrupts | grep timer && sleep 1 && cat /proc/interrupts | grep timer*  
0: 9309306 IO-APIC-edge timer  
0: 9309562 IO-APIC-edge timer

上四個欄位分別為中斷號碼、CPU中斷次數、PIC與裝置名稱。timer interrupt會做 (1)更新時間、日期與系統從開機至目前經過多少時間。(2)更新系統資源使用率統計。(3)檢查正在執行的程序是否超過分配的執行時間額度。如果是，則侵佔(preempt)該程序以利執行其它等待執行的程序。(4)檢查軟體時間器(Software timer，如alarm系統呼叫)跟時間延遲函式(Delay function)的延遲時間是否已經超過。  
*Jiffies為Linux核心變數(32位元變數，unsigned long)*，紀錄系統自開幾以來經過多少的tick。每次timer interrupt，Jiffies會被加一。Jiffies於系統開機時並非初始化成零，而被設為-300\*HZ (*arch/i386/kernel/time.c*)，系統開機五分鐘後，jiffies會溢位。x86架構定義一個與jiffies相關的變數jiffies\_64(64位元)，jiffies被對應至jiffies\_64的低32位元。因此經由jiffies\_64可以完全不理會溢位的問題便能取得jiffies。

# *cat /proc/cpuinfo*: the CPU information.

*# cat /proc/ioports*: the IO port. Some default IO ports are defined by BIOS. Use *request\_region()/release\_region()* to register/unregister IO ports and the information is from */proc/ioports*:

*#define SPI\_BASE\_ADDR 0xf00*

*request\_region(SPI\_BASE\_ADDR, 4, “spi”);*

Then you can see in */proc/ioports*:

*0xf00-0xf04 : “spi”*.

*# cat /proc/module*: the modules installed in this system.

*# cat /proc/version*: the version of Linux kernel and gcc. (*uname –r* can only shows the kernel version.)

*# cat /proc/cmdline*: the kernel command line.

The following command will only show the error message of level 2: *# make –j4 2> error.txt*.

To use SSH to remote log-in a Linux system, type the following command: *# ssh –X price@192.168.1.120*.

To clear the kernel message, use *dmesg –c*.

Ubuntu uses */bin/bash* shell and Android uses */system/bin/sh*. While writing shell script, mind to use the proper shell in different OS, otherwise the script can’t run properly.

Before building the new kernel, mind to clean the old files first.

Use *modprobe* to install the Linux driver which is marked as “m” in *.config* and this command can be executed anywhere in Linux.

Before building kernel, mind that use *make mrproper* or *make clean* to clean the old files. Usually, *make mrproper* is only used for the first time because it remove all the files including *.config* and *Module.symvrs* in each module folder. Use *make* to build Linux kernel, but the modules which is marked as “M” in *menuconfig* are not be compiled. Then use *make modules* to build these modules and finally use *make modules\_install* to install these modules in */lib/modules/<Linux kernel>/kernel…*

If the build machine is 64-bit one, make sure of adding *ARCH=i386* before building kernel image. You can check *CONFIG\_X86\_32=y* and *CONFIG\_X86\_64* is not set in the *.config* file. The command is:

# *make ARCH=i386 menuconfig*.

To search for the files and edit them: *#find . –name \*.reg | xargs gedit*.

Linux kernel source code exists in */usr/src/linux-headers-2.6.38.33-generic/*. The binary kernel after compiling is in */lib/modules/2.6.38.33/kernel/* and you can see some symbolic links to the real source code.

*dd*可從標準輸入裝置(或檔案讀取資料)經指定的格式來轉換資料，再輸出至檔案、裝置或標準輸出。This command can be categories into three levels: disk, partition and file. The copy can be (1) disk to disk. (2) partition to partition. (3) disk, partition, file to file. (4) file to disk, partition.

Disk to disk:硬碟整個到另一顆硬碟備分的指令：*＃dd if=/dev/hda of=/dev/hdb*. (硬碟對拷格式需一致，因不同硬碟有不同Sector和Cylinder的大小，拷備到目地槽可能會發生檔案讀取錯誤；若Flash或CF卡則無此問題)

Partition->partition:一個Partition到另一Partition備分的指令：*＃dd if=/dev/sda1 of=/dev/sdb1*.

In the disk, the first sector is MBR and FAT. This information belongs to entire disk. Then there are data in different partitions which are stored in order. If you use *dd* command to copy data between partitions, the data in MBR and FAT will not be copied.

備份: *dd if=/dev/hda1 of=/home/backup\_system/file\_name.* 還原: *dd if=/home/backup\_system/file\_name of=/dev/hda1* (如果要備分的是partition，不能將"要備分的分割區"放在同一個partition內，如：*# dd if=/dev/hda1 of=/dev/hda2/copy\_datas*).

The TREK550 CAN device divided into two layers: (1) Physical device driver: *interrupt\_driver.ko* calls the CAN sdk provided by chip vendor to communication with SPI directly and exports another set of sdk used by *canbus.ko*. Since the driver has to access the SPI which means it is required to register the IO space in x86 CPU. Use *request\_region()* and *release\_region()* to register/unregister the space which is used by CAN driver (Type #*cat /proc/ioports* so that you the address named “spi”). (1) Virtual device driver: *canbus.ko* register the device number and IRQ (using *request\_irq()*, type #cat */proc/interrupts* so that you can see the IRQ named “can\_spi”) in *module\_init()*. The opposite things are called in *module\_exit()*. Then, initialize the CAN controller so that it starts to access CAN data.

Linux 2.6.19以後，中斷處理interface有改變。*IRQF\_xxx*型中斷標誌取代了*SA\_xxx*型中斷標誌。在較早的内核中應該使用*SA\_INTERRUPT*而不是*IRQF\_DISABLED*來將中斷處理標記為快中斷處理。

*request\_irq(IRQ\_NUM, corgikbd\_interrupt, IRQF\_DISABLED | IRQF\_TRIGGER\_RISING, "corgikbd", corgikbd);*

Linux driver中名為“interrupt handler”的routine負責處理實體的硬體中斷。當裝置中斷被觸發時，interrupt handler會執行回應該中斷的請求。Interrupt handler執行於interrupt mode，無process context資訊。在interrupt mode：1. 無process context，因此無法存取user space。2. 無法存取*current*巨集。*current*是指向自己的kernel symbol。3. 無scheduler做排程，也不能sleeping waiting。由於down/up的semaphore API是sleeping waiting的版本，因此在interrupt mode須改用spinlock，以busy waiting的方式做wait operation。Linux driver安裝interrupt handler是呼叫*int request\_irq( unsigned int irq, void (\*handler)(int, void \*, struct pt\_regs \*), unsigned long irqflags, const char \*devname, void \*dev\_id);*

呼叫*request\_irq()*安裝interrupt handler的位置為：1. *init\_module()*. 2. *fops->open*. 共用中斷只能在*fops->open*裡呼叫*request\_irq()*。在 *fops->open*裡請求IRQ，相對的要在*fops->release*裡呼叫*free\_irq()*將佔用的IRQ釋放。

The *DECLARE\_WAIT\_QUEUE\_HEAD* macro declares a wait queue to make the process sleep. The process goes to sleep by exploiting *wait\_event\_interruptible()*. In CAN driver, when interrupt occurs, the ISR is called which get the CAN data from the queue. Then use *wake\_up\_interruptible()* to invoke the process. The pseudo-codes are shown below:

*DECLARE\_WAIT\_QUEUE\_HEAD(WaitQ);*

*INT Flag = 0;*

*adv\_canbus\_ioctl(…){if(cmd == …){ wait\_event\_interruptible(WaitQ, Flag != 0); Flag = 0;}}*

*static irqreturn\_t adv\_canbus\_isr(int irq, void\* arg) {… Flag = 1; Wake\_up\_interruptible(&WaitQ);}*

kernel 2.6.35及之前*struct file\_operations* 共有3个*ioctl*：*ioctl*, *unlocked\_ioctl*和*compat\_ioctl*。kernel 2.6.36中删除*struct file\_operations*的*ioctl*函数指针，並以*unlocked\_ioctl*取代。改变后参数少了*inode*，用户程序中的*ioctl*对应的系统调用接口没有变化，所以用户程序不需要改变，一切都交给内核处理。*unlocked\_ioctl*取代*ioctl*。Caution: since the difference between *unlocked\_ioctl()* and *ioctl()* is just the *inode*, so if you use *file\_operations::unlocked\_ioctl()* to point to *ioctl()* in the driver, the compiler can still pass, but the arguments are totally incorrect. *ioctl()* is still used in user mode.

**How to check x86 or x64 CPU in linux?**

*# cat /proc/cpuinfo* | *grep flags* or *lscpu*

rm(real mode): 16-bit, tm(transparent mode): 32-bit, lm(long mode): 64-bit

**How to check x86 or x64 Ubuntu?**

# *uname -m*

x86\_64: 64-bit kernel, i686: 32-bit kernel

如果已定义*KERNELRELEASE*，则说明是从内核整体编译的Make中调用。在内核的Makefile中L350行相關于定义：*KERNELRELEASE = $(shell cat include/config/kernel.release 2> /dev/null)*  
ifneq ($(KERNELRELEASE), ) # Using Linux building system to compile.obj-m := hello.oelse

#否则，是直接从命令行调用，这时需要调用内核构造系统，对$(shell uname -r)会得到Linux系统版本相关信息KERNELDIR ?= /lib/modules/$(shell uname -r)/buildPWD := $(shell pwd)Build:    $(MAKE) -C $(KERNELDIR) M=$(PWD) modulesendif

Use ldd to check which SO file the executable/library needs, like ldd ./libSUSI.so. If a so file needs another so file in the same path, but fails to find it, the local variable LD\_LIBRARY\_PATH should be set.

步骤一：在被依赖的模块B中导出要用的符号,如：

*int cat9555\_state\_get\_inp(void){ ................ }*

*EXPORT\_SYMBOL(cat9555\_state\_get\_inp);*

步骤二：编译模块B，当前目录下生成*Module.symvers*，将其复制到模块A的目录下。*Module.symvers*内容如下：  
*0x20473c2b cat9555\_state\_get\_inp /home/project/MeterRead/gpio/gpio EXPORT\_SYMBOL*

步骤三：在模块A的文件中引用导出的符号。

*extern cat9555\_state\_get\_inp(void);*      //声明引用的符号是外部变量。

*int f(){cat9555\_state\_get\_inp();*  //在这里引用导出的符号}

编译A模块。我如果没有步骤二的话，插入A模块时会出现以下错误(找不到符号)：

*gprsiodrv: no symbol version for cat9555\_state\_get\_inp  
gprsiodrv: Unknown symbol cat9555\_state\_get\_inp  
insmod: cannot insert 'gprsiodrv.ko': unknown symbol in module*

但有人不用步骤二也可以，猜测与编译器有关。

If you use the console windows to invoke the application and then hope to run in the background, then use *Ctrl+Z* to unhook the application and type: *#bg*, the application can switch from foreground to background.

*#cat /proc/tty/driver/serial* lists the usage statistics and status of each of the serial *tty* lines like:

*0: uart:16550A port:3F8 irq:4 tx:0 rx:0  (2 wires)*

*1: uart:16550A port:2F8 irq:3 tx:6 rx:11245 bark:12 RTS|DTR|DST  (6 wires).*

16550A is the COM port IC and replaces with 8250. You can read the times of sending and receiving data from tx and rx.

*# dmesg | grep tty* shows the mapping of COM port number:

Serial8250: ttyS0 at I/O 0x3f8 (irq = 4) is a 16550A

Serial8250: ttyS1 at I/O 0x2e8 (irq = 3) is a 16550A

In Linux, if you would like to find the relation between COM\* (Defined by BIOS) with ttyS\* (Defined by Linux kernel), check the “Super IO Configuration” page in BIOS to find every COM port and its corresponding IO address and IRQ number. Then you can type *#dmesg | grep ttyS\** in Linux kernel so that you can get every *ttyS\** device node and its corresponding IO address and IRQ number. Find the mapping of IO address and IRQ number between two lists then you can find the relation between *COM\** and *ttyS\**.

The default value of setting maximum number of 8250/16550 serial ports is 4. To set the value to 6, modify *CONFIG\_SERIAL\_8250\_NR\_UARTS=6* and *CONFIG\_SERIAL\_8250\_RUNTIME\_UARTS=6.*

守护进程是脱离终端的，他的信息无法直接输出到标准输出和错误输出设备，Linux系统中提供了*syslog()*系统调用。

*#include <syslog.h>*

*void main(void) {*

*openlog("slog", LOG\_PID|LOG\_CONS, LOG\_USER);*

*syslog(LOG\_INFO, "A different kind of Hello world ... ");*

*closelog();*

*}*

You can use the command: *# tail -f /var/log/messages* to show the dynamic kernel message.

Linux块设备操作可分为两类：1. C标准库中的*fopen/fread/fwrite* (buffered I/O)。I/O path為: Application<->Library Buffer<->OS Cache<->File System/Volume Manager<->Device。library buffer是标准库提供的用户空间的buffer，通过setvbuf改变大小。2. Linux的系统调用*open/read/write* (non-buffered I/O)。I/O path為: Application<-> OS Cache <->File System/Volume Manager<->Device。

设置*open*為*O\_DIRECT*实现Direct I/O(或叫Raw I/O)，绕过OS Cache，直接读取Device，等于将OS cache换成自己管理的cache。如果是大量随机写入操作，*O\_DIRECT*会提升效率。但是顺序写入和读取效率都会降低。字詞轉換是中文維基的一項自動轉換，目的是通過電腦程式自動消除繁簡、地區詞等不同用字模式的差異，以達到閱讀方便。字詞轉換包括全域轉換和手動轉換，本說明所使用的標題轉換和全文轉換技術，都屬於手動轉換。

如果您想對我們的字詞轉換系統提出一些改進建議，或者送出應用面更廣的轉換（[中文維基百科](http://zh.wikipedia.org/wiki/中文维基百科)全站乃至[MediaWiki](http://zh.wikipedia.org/wiki/MediaWiki)軟體），或者報告轉換系統的錯誤，請前往[Wikipedia:](http://zh.wikipedia.org/wiki/Wikipedia:字词转换请求或候选)字詞轉換請求或候選發表您的意見。Use *lsmod* to check which drivers are installed in the machine.

If you add “*-soname*” attribute while building the SO file, the SO file or its symbolic link must exist in the compiling time. For example:

In library: *gcc -shared -Wl,-soname,libtest.so -o libtest.so.1.0.0*

In app: *gcc testdemo.c -o testdemo -Wl,--start-group libtest.so.1.0.0 --end-group*

Mind to create symbolic link: *ln –s libtest.so.1.0.0 libtest.so.1* otherwise the error occurs while running.

Before accessing the IO port, call *ioperm()* or *iopl()* to tell the system to provide the access right, otherwise, the segmentation faults occur. If the program exploits *inb(), outb()*, ...,etc, to access the ports, mind adding *–O* attribute to turn on the compiler optimization.

In Linux, there are lots of files whose names are the same but locating in different path. Take *io.h* for example, in user mode, it exists in */usr/lib/sys*, but in *${LinuxKernl}/include/asm-generic* in kernel mode.

x86架構主機開機第一個被讀取的是BIOS(Basic Input Output System)，BIOS裡記錄主機板晶片組與相關設定，如CPU與周邊設備的溝通時脈、開機裝置的搜尋順序、硬碟大小與類型、系統時間、各周邊匯流排是否啟動Plug and Play(PnP, 隨插即用裝置)、各周邊設備的I/O位址、以及與CPU溝通的IRQ岔斷等等。BIOS瞭解主機硬體資訊後，主機開始由儲存媒體載入作業系統，系統會去第一個開機裝置上進行開機程序。開機流程讀到硬碟的過程中，第一個要讀取的是該硬碟的主要開機磁區(Master Boot Record, MBR)，系統可由MBR所安裝的開機管理程式(boot loader)**執行核心辨識的工作**。每顆硬碟的第一個磁區稱為MBR，若主機上有兩顆硬碟，系統會看BIOS的設定。『系統的 MBR』指的是第一個開機裝置的MBR！想載入Linux核心，得用支援Linux file system的boot loader，目前主流的grub開機管理程式，可支援Linux及Windows的核心系統！因Windows和Linux的檔案格式不一樣！為了載入系統核心，必須安裝認識OS的loader，而Linux的loader (lilo或grub)認識windows的核心檔案，但Windows的loader卻不認識Linux的核心檔案，因此Windows提供的loader不能作為多重開機的loader。藉由boot loader的管理讀取核心檔案後，接著Linux會將核心解壓縮到主記憶體中，並利用核心的功能開始測試與驅動各個周邊裝置，包括儲存裝置、CPU、網路卡、音效卡等。一般核心檔案會被放置到*/boot*裡，並取名為*/boot/vmlinuz*！

OS核心須認識磁碟檔案系統才能讀取資料，要有boot loader才能載入Linux的kernel！在載入核心的過程中，系統只會以唯讀的方式『掛載根目錄』。為了讓某些功能可用檔案的方式讀取，有的系統開機時需虛擬硬碟(RAM Disk)輔助，即initrd和linuxrc。boot loader載入核心時一起載入initrd的映象檔(*/boot/initrd-xxxx.img*)，Linux系統會主動以initrd來進行虛擬硬碟的建置，並利用linuxrc(包含在initrd的映象檔內)的功能載入模組。在核心驅動周邊硬體工作完成後initrd建立的虛擬磁碟就會被移除！不過initrd非必要。核心載入後主機就開始運作，接著執行系統的第一支程式：*init*。

核心一般是壓縮檔，核心要解壓縮才載入記憶體。核心有『可讀取模組化驅動程式(modules)！該程式可能由硬體開發商提供或核心支援～不過新的硬體，通常由硬體開發商提供！核心：/boot/vmlinuz 或/boot/vmlinuz-version；核心解壓縮所需RAM Disk：/boot/initrd (/boot/initrd-version)；核心模組：/lib/modules/`uname -r`/kernel；核心原始碼：/usr/src/linux (要安裝才有！預設不安裝！) 。

To establish a multi-OS x86 system, Windows should be installed first and then Linux. The steps are as followed: (1) In Windows, use disk management tool (like partition master) to re-partition the hard drives and leave some space as “unallocated”. (2) While installing Linux, create the disk partition manually based on the “unallocated” space. Mind that there are at least two partitions: */* and *SWAP*.

To add the touch screen driver, add the codes in *linux/kernel/drivers/input/touchscreen/kconfig* as below:

*config TOUCHSCREEN\_USB\_PENMOUNT*

*default y*

*bool “Dialogue PenMount tablet device support” if EMBEDDED*

*depends on TOUCHSCREEN\_USB\_COMPOSITE*

*TOUCHSCREEN\_USB\_PENMOUNT* depends on *TOUCHSCREEN\_USB\_COMPOSITE*. If you set *TOUCHSCREEN\_USB\_COMPOSITE=y* then you can see *TOUCHSCREEN\_USB\_PENMOUNT=y* in *.config*. Otherwise, *TOUCHSCREEN\_USB\_PENMOUNT* disappears when *TOUCHSCREEN\_USB\_COMPOSITE* is not set. Add the implementation of touch panel in *linux/kernel/drivers/input/touchscreen/usbtouchscreen.c*. Besides, define vendor and device ID for PenMount in *linux/kernel/drivers/hid-ids.h*. Set *TOUCHSCREEN\_USB\_PENMOUNT=y* in *android/device/…/xxx\_defconfig*.

Despite the popularity of I/O ports in the x86 world, the main mechanism used to communicate with devices is through memory-mapped registers and device memory. Both are called I/O memory because the difference between registers and memory is transparent to software.

I/O device透過I/O port存取與控制。I/O device的存取變成記憶體存取。使用者存取I/O裝置就會和CPU的記憶體存取一樣。Linux提供I/O port存取介面：*inb()*, *outb(),...*。若存取I/O memory，則改用*readb()*, *writeb()*。

I/O memory is a region of RAM-like locations that the device makes available to the processor over the bus, and implementing device registers that behave like I/O ports. Depending on the computer platform and bus, I/O memory may or may not be accessed through page tables. When access passes though page tables, the kernel must first arrange for the physical address to be visible from your driver, which means you must call *ioremap**() before doing any I/O. If no page tables are needed, I/O memory locations look pretty much like I/O ports, and you can just read and write to them using proper wrapper functions.* I/O memory regions must be allocated prior to use. The interface for allocation of memory regions (linux*/ioport.h*) is:

*struct resource \*request\_mem\_region(unsigned long start, unsigned long len, char \*name);*

This function allocates a memory region of *len* bytes, starting at *start*. If all goes well, a non-NULL pointer is returned; otherwise the return value is *NULL*. All I/O memory allocations are listed in */proc/iomem*.

Memory regions should be freed when no longer needed:

*void release\_mem\_region(unsigned long start, unsigned long len);*

Once equipped with *ioremap* (and *iounmap*), a device driver can access any I/O memory address, whether it’s directly mapped to virtual address space. The functions are called defined in *asm/io.h*:

*void \*ioremap(unsigned long phys\_addr, unsigned long size);*

*void iounmap(void \* addr);*

In old version SUSI library, the library switch the privilege mode from user mode to kernel through *iopl()*, so that it can access the IO port by using *inb()*, *outb()*,…etc. It is not safe enough. In the new version, all the codes relative to IO port access have already migrate into kernel, and are implemented in Linux driver.

The functions: *dlopen(), dlsym(), dlclose(), dlerror()* implement the interface to the dynamic linking loader.

*#include <[dlfcn.h](http://linux.die.net/include/dlfcn.h)>*

*void \*dlopen(const char \*filename, int flag);*

*char \*dlerror(void);*

*void \*dlsym(void \*handle, const char \*symbol);*

*int dlclose(void \*handle);*

Link with *-ldl*.

*dlerror()* returns a human readable string describing the most recent error that occurred from *dlopen()*, *dlsym()* or *dlclose()* since the last call to *dlerror()*. It returns *NULL* if no errors have occurred since initialization or since it was last called.

*dlopen()* loads the dynamic library file named by the null-terminated string *filename* and returns an opaque "handle" for the dynamic library. If *filename* is NULL, then the returned handle is for the main program. If *filename* contains a slash ("/"), it is interpreted as a (relative or absolute) path name. The *flag*:

*RTLD\_LAZY*: Perform lazy binding. Only resolve symbols as the code that references them is executed. If the symbol is never referenced, then it is never resolved

*RTLD\_NOW*: If this value is specified, all undefined symbols in the library are resolved before *dlopen()* returns. If this cannot be done, an error is returned.

If the same library is loaded again with *dlopen()*, the same file handle is returned. The *dl* library maintains reference counts for library handles, so a dynamic library is not deallocated until *dlclose()* has been called on it as many times as *dlopen()* has succeeded on it. If *dlopen()* fails for any reason, it returns *NULL*. The function *dlsym()* takes a "handle" of a dynamic library returned by *dlopen()* and the null-terminated symbol name, returning the address where that symbol is loaded into memory. If the symbol is not found, *dlsym()* returns *NULL*. Since the value of the symbol could actually be *NULL*, the correct way to test for an error is to call *dlerror()* to clear any old error conditions, then call *dlsym()*, and then call *dlerror()* again, saving its return value into a variable, and check whether this saved value is not *NULL*. *dlclose()* decrements the reference count on the dynamic library handle *handle*. If the reference count drops to zero and no other loaded libraries use symbols in it, then the dynamic library is unloaded. *dlclose()* returns 0 on success, and nonzero on error. For example, load the math library, and print the cosine of 2.0:

*#include <[stdio.h](http://linux.die.net/include/stdio.h)>*

*#include <[stdlib.h](http://linux.die.net/include/stdlib.h)>*

*#include <[dlfcn.h](http://linux.die.net/include/dlfcn.h)>*

*int main(int argc, char \*\*argv){*

*void \*handle;*

*double (\*cosine)(double);*

*char \*error;*

*handle = dlopen("libm.so", RTLD\_LAZY);*

*if (!handle) { fprintf(stderr, "%s\n", dlerror()); exit(EXIT\_FAILURE); }*

*dlerror(); /\* Clear any existing error \*/*

*\*(void \*\*) (&cosine) = dlsym(handle, "cos");*

*if ((error = dlerror()) != NULL) { fprintf(stderr, "%s\n", error); exit(EXIT\_FAILURE); }*

*printf("%f\n", (\*cosine)(2.0));*

*dlclose(handle);*

*exit(EXIT\_SUCCESS);*

*}*

To build "*foo.c*" which loads the library dynamically: *gcc -rdynamic -o foo foo.c -ldl*

socket是pipe的延伸。pipe建立一個通道來傳遞訊息，但pipe只能在本機電腦上。socket是一個機制，允許client跟server溝通，socket跟pipe一樣可以read跟write，且能跨越網路，所以process之間溝通不一定要在同電腦上。socket連線步驟: 1. 通常server的應用程式要先產生socket，使用system call *socket*。2. 給socket名字(port 80)。3. socket取名稱做systen call *bind*。4. server等待client連線。5. system call *listen*，並產生一個queue讓client連線。6. 系統可以system call *accept*來允許連線。

關鍵字前面為*AF\_*表address family，*PF\_*為protocol family。*PF\_UNIX*跟*PF\_LOCAL*不能跨越網路，而是在檔案系統溝通，*PF\_INET*使用IPv4的網路協定，*PF\_INET6*使用IPv6的協定。

**iptables**

*iptables*內建鏈(*INPUT*, *FORWARD*, *OUTPUT*)不帶任何規則，所有鏈預設為 *ACCEPT*。最常用的是 *append(-A)* 和*delete(-D)* 命令。每條規則都限定了一組條件(conditions)與特定封包比對，及當符合時要如何處置(指一個`target' )。如要丟棄來自127.0.0.1的 ICMP封包，條件為﹕協定ICMP來源地址127.0.0.1，target(目標)是’*DROP*’。

*# ping -c 1 127.0.0.1*

*PING 127.0.0.1 (127.0.0.1): 56 data bytes*

*64 bytes from 127.0.0.1: icmp\_seq=0 ttl=64 time=0.2 ms*

*--- 127.0.0.1 ping statistics ---*

*1 packets transmitted, 1 packets received, 0% packet loss*

round-trip min/avg/max = 0.2/0.2/0.2 ms

*# iptables -A INPUT -s 127.0.0.1 -p icmp -j DROP*

*# ping -c 1 127.0.0.1*

*PING 127.0.0.1 (127.0.0.1): 56 data bytes*

*--- 127.0.0.1 ping statistics ---*

*1 packets transmitted, 0 packets received, 100% packet loss*

有兩個方法可移除規則。首先，因為制定在 input 鏈中只有唯一一條規則，可以指定數字來移除﹐例如﹕

*# iptables -D INPUT 1*

第二個方法是映射(mirro)上面的 -A 命令﹐但用 -D 來代替 -A 而已。

*# iptables -D INPUT -s 127.0.0.1 -p icmp -j DROP*

命令行中，*-D*和*-A*命令的位置一致。如果在同一個鏈中有數條相同的規則，那只有第一條會被移除掉。

*-p(--protocol*)指定協定，協定可為號碼，或是一個如 TCP，UDP，ICMP的名稱。大小寫沒關係，所以tcp和TCP都可。*-s*(*--source*，*--src*)指定來源IP，*-d*(*--destination*，*--dst*) 指定目的IP。可用完整名稱，如[www.linuxhq.com](http://www.linuxhq.com)或localhost。第二種方法是指定IP 地址，例如127.0.0.1。也可指定一組(group) IP地址，如 199.95.207.0/24或 199.95.207.0/255.255.255.0。許多旗標(flags)，如*-s*和*-d*，前可放*!*來符合所有非(NOT)其賦予值的地址。*-p ! TCP*指定了所有**非** TCP 的封包。*-s ! localhost*符合所有**非**來自本機的封包。

The command, *grep -R "SmsFilterData" ./dom/sms/ | cut -d ':' -f 1 | sort -u | wc -l*, shows: search for the key word in a designated folder, acquire the first field in each line, sort them and then count the amount.

Building codes with *gcc*, the error: Relocation *R\_X86\_64\_32* against `vtable for Torch::MemoryDataSet' can’t be used when making a shared object; recompile with *–fPIC*. This problem is related with the use of a 64 bits machine, and exploits *CXXFLAGS* instead of *CFLAGS* when using *g++* to compile the codes.

Cut and paste in VIM: (1) Position the cursor where you want to begin cutting. (2) Press v (or upper case V if you want to cut whole lines). (3) Move the cursor to the end of what you want to cut. (4) Press d (cut) or y (copy). (5) Move to where you would like to paste, and press p to paste after the cursor, or P to paste before. (d:delete or y:yank).

从命令行执行*history*後，通常只会显示已执行命令的序号和命令本身。如果想查看命令历史的时间戳，可以执行：

*# export HISTTIMEFORMAT='%F %T '*

*# history | more*

NTP 要另外安裝才能發揮持續更新調整時間的功能。安裝 NTP，指令為： *$ sudo apt-get install ntp*

編輯時間伺服器組態檔案 ntp.conf。指令為： *$ sudo vi /etc/ntp.conf. ntp.conf* 檔案的內容如下：

* 第1行Server後面填入time.stdtime.gov.tw：server time.stdtime.gov.tw。
* 第2行Server後面填入clock.stdtime.gov.tw：server clock.stdtime.gov.tw。

測試指令：*$ sudo ntpdate time.stdtime.gov.tw*

回應：28 Aug 13:12:09 ntpdate[29439]: adjust time server 220.130.158.52 offset -0.126794 sec

現在Ubuntu Server可以自行管理時間了

Ubuntu 64bit需安裝*ia32-libs*才能跑32bit的程式。Ia32 contains runtime libraries for the ia32/i386 architecture, configured for use on an amd64 or ia64 Debian system running a 64-bit kernel.

SSH分客戶端openssh-client和openssh-server 。登陸別的機器SSH只需安裝*openssh-client*(ubuntu默認安裝，如沒則*sudo apt-get install openssh-client*)，要使本機開放SSH服務就要安裝*openssh-server*: *sudo apt-get install openssh-server*，然後確認sshserver是否啟動：*ps -e | grep ssh* 。如看到*sshd*說明ssh-server已經啟動。如果沒有則：*sudo /etc/init.d/ssh start*。ssh-server配置文件位於/ etc/ssh/sshd\_config，可定義SSH的服務端口，默認端口是22，可以定義其他端口號，如222。然後重啟SSH服務：*sudo /etc/init.d/ssh restart*。登陸SSH：*ssh tuns@192.168.0.100*，tuns為192.168.0.100機器上的用戶，需要輸入密碼。斷開連接：exit。

**Ubuntu Linux: Uninstall / Remove Any Installed Software**

1. GUI Package Management Tool: *synaptic* is graphical management tool of software packages. It allows you to perform all actions of the command line tool *apt-get* in a graphical environment. Click on System > Administration > Synaptic Package Manager, and select any package and click on **Mark for Removal** popup menu. You can also start GUI tool from command line, enter: *$ synaptic &*

2. Command Line Package Management Tool: *apt-get* is the command-line tool for handling packages. It is used for adding / removing / updating packages. For example, to remove a package, use the following syntax: *sudo apt-get remove {package-name}*.

**How to add a new user in Ubuntu**

*$ sudo useradd myuser* (Without a home directory)

*$ sudo useradd -m myuser* (With a home directory)

*$ sudo passwd myuser* (Then set the password)

*$ sudo usermod -s /bin/bash myuser* (Then set the shell)

To kill a port in Linux:

*$ fuser -n tcp 10880*

*10880/tcp*

*$ fuser -k 10880/tcp*

用vi對一些字copy/cut: (1) 先將游標移到開始的位置按下"v"，command 出現"VISUAL”。 (2) 移動游標到結束的位置，移動時可看到字反白，這是選取的區域。 (3) 按下"d"作cut動作，或"y"作copy動作，此時反白消失，command的"VISUAL也不見。4. 移動游標到目的位置，按下"p" 貼上。

Linux下寫好自己動態鏈接庫，需在其它程序調用，要讓程序找到動態鏈接庫。如設置不對，會出現如下錯誤：*test: error while loading shared libraries: libexampleso.so.0: cannot open shared object file: No such file or directory*.

這是因為沒把動態鏈接庫的安裝路徑(如*/usr/local/lib*)放到變量*[LD\_LIBRARY\_PATH](http://baike.baidu.com/view/1270749.htm)*裡。可用***export***測試確認問題：*export LD\_LIBRARY\_PATH =/usr/local/lib*

以上做法只臨時設置變量***LD\_LIBRARY\_PATH***，下次開機一切設置將不存在；可在***~/.bashrc***或***~/.bash\_profile***中加入*export*語句，前者在每次登陸和每次打開shell都讀取一次，後者只在登陸時讀取一次。在該文件的未尾，可採用如下語句來使設置生效：*export LD\_LIBRARY\_PATH =$ LD\_LIBRARY\_PATH :/usr/local/lib*

gcc編譯時加*-g*，GDB出現：Reading symbols from /home/XX/XX...(no debugging symbols found)...done.

* 1. 用*.o*文件*gcc -g*生成一個可執行文件。選項*gcc \*.o -o \**，加不加*-g*選項無所謂。主要是生成.o文件需要加*-g*。
  2. *gcc -c -g \*.c gcc -o exe \*.o*

1. 假設2個cpp檔要 patch，分別於 cpp/data1/file.cpp 及cpp/data2/file2.cpp，可將 diff 的結果放在同個檔案內︰
2. *--- old/data1/file1.cpp 2007-11-23 10:07:59.737150770 +0000  
   +++ new/data1/file1.cpp 2007-11-23 10:21:07.780929751 +0000  
   @@ -2,4 +2,5 @@  
   void main() {  
   std::cout << "Hello World!!\n";  
   + std::cout << "This is my patch example.\n";  
   }  
   --- old/data2/file2.cpp 2007-11-23 10:07:59.737150770 +0000  
   +++ new/data2/file2.cpp 2007-11-23 10:21:54.503801884 +0000  
   @@ -2,4 +2,5 @@  
   void main() {  
   std::cout << "Hello World!!\n";  
   + std::cout << "This is 2nd patch example.\n";  
   }*
3. 使用這個 patch 的方法就是要先進入 cpp 這個目錄下再執行 patch 指令︰
4. *# cd cpp*
5. *# patch -p1 < my\_patch\_file*
6. patch 根據 new/data1/file1.cpp及new/data2/file2.cpp ，忽略前面的new，進入data1及data2目錄patch file1.cpp 及 file2.cpp 。