

Android Porting

Android on PXA270 之操作步驟

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作者簡介

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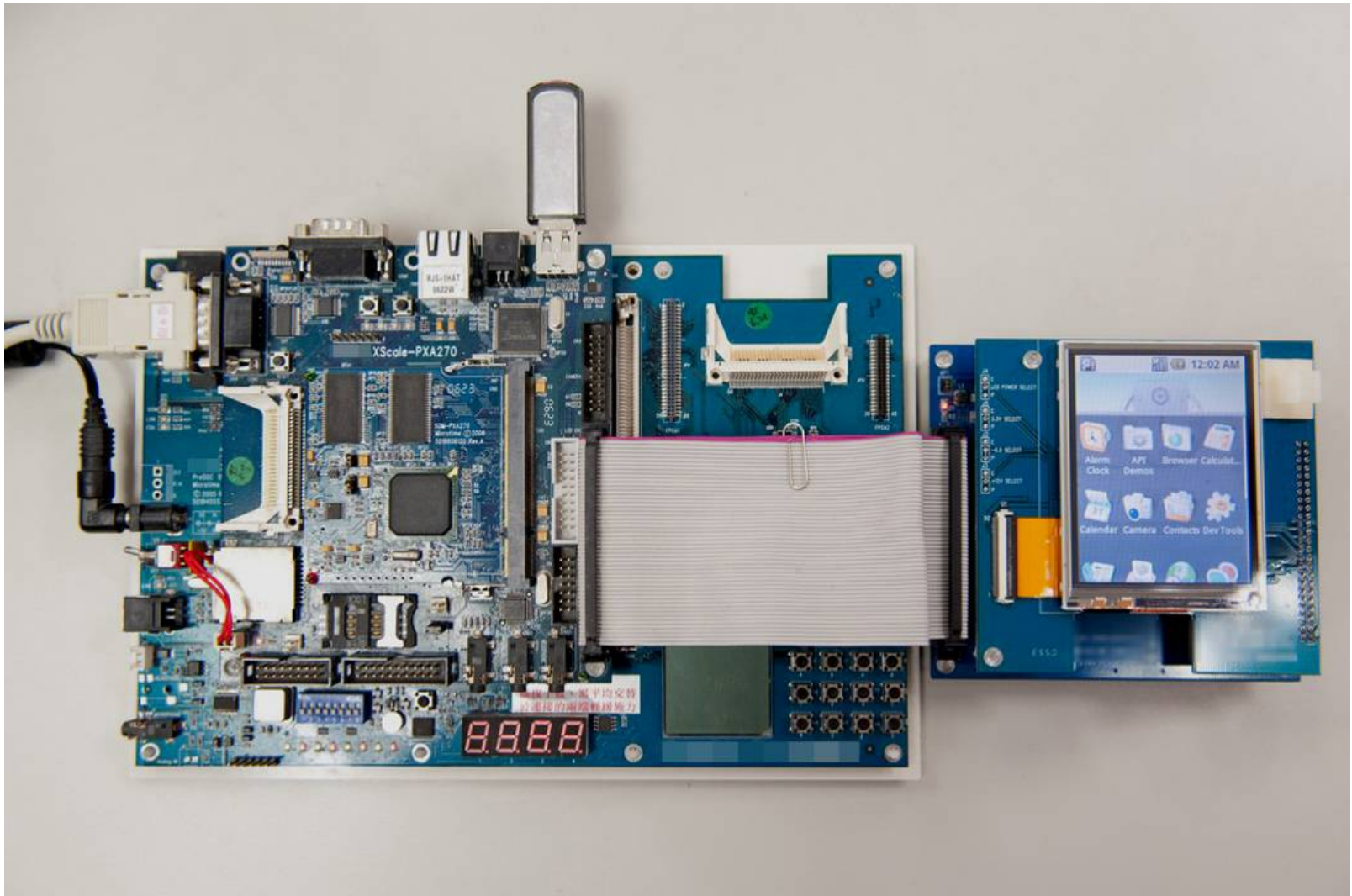
鍾文昌 Mask <cycdisk@gmail.com>

- 數年 Linux 及 Embedded Linux 相關開發經驗，開發產品包含 Set-Top-Box、手機及快速開機軟體等相關產品，接觸過 x86、MIPS 及 ARM platform，對 Linux kernel、Linux device driver、Shared Library、Application 等皆有所涉獵。
- 在 IC 廠完全沒有支援 Android 的情況下，獨立移植 Android 至 PXA270、OMAP3530 等硬體平台。
- 豐富的 Android Porting 授課經驗。



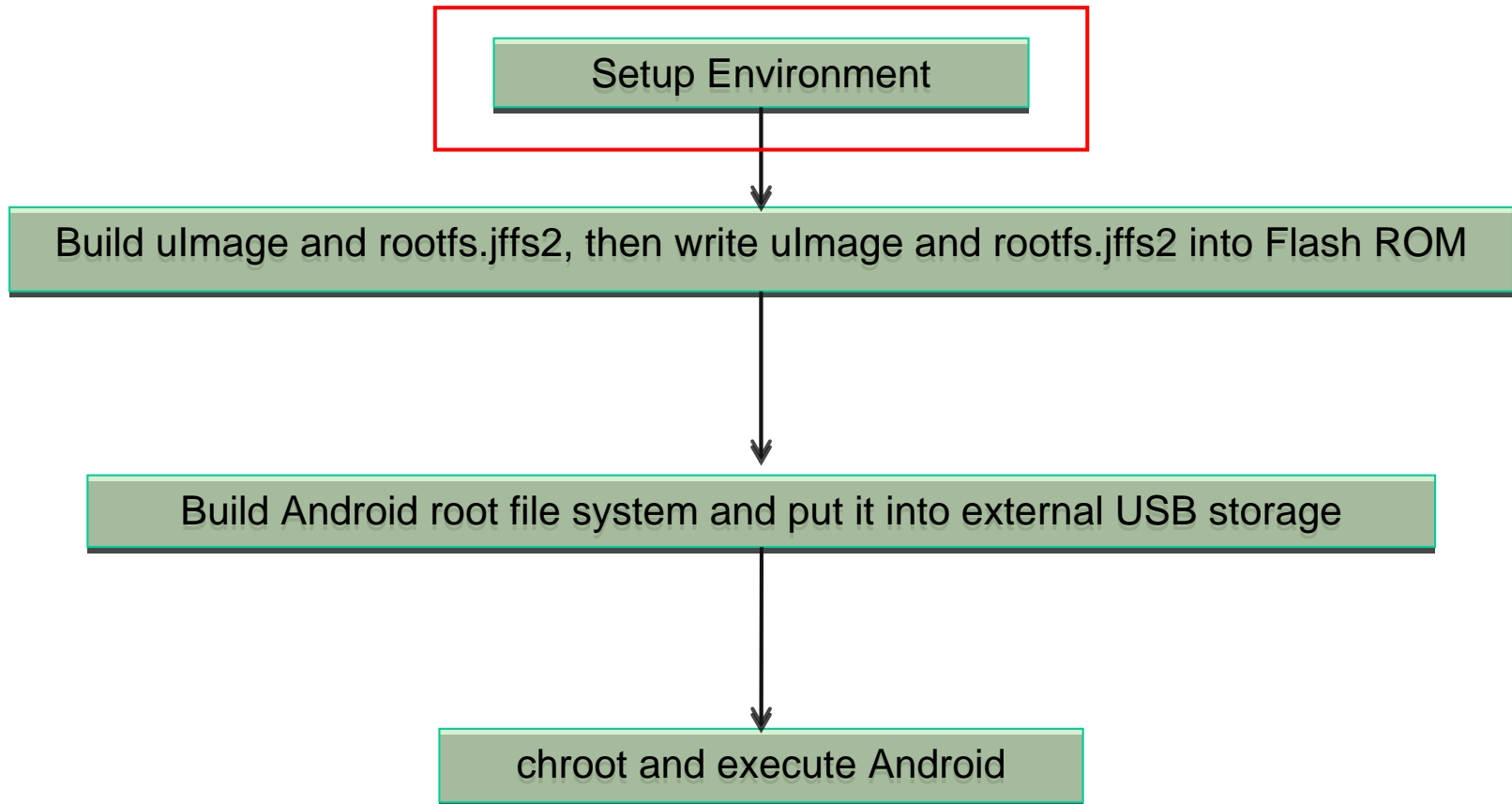


Android 1.0 on PXA270





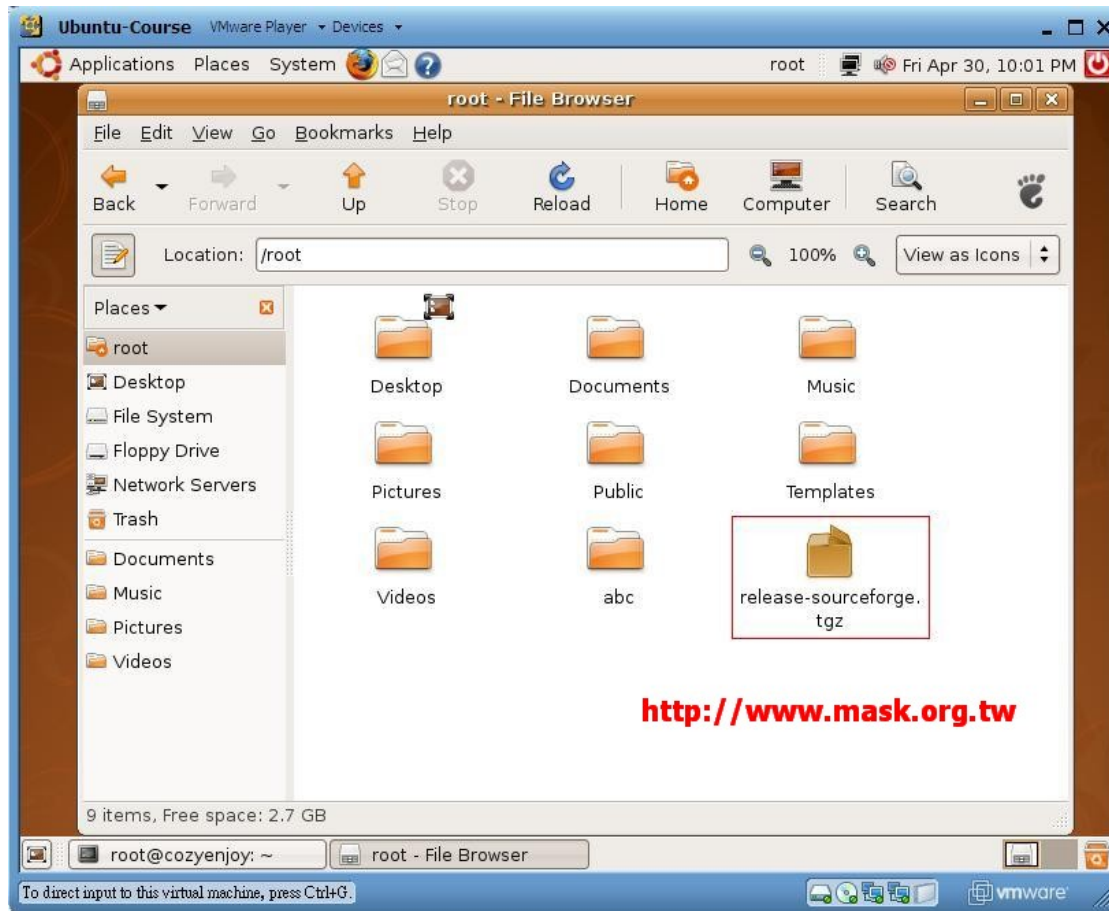
Bring Up Android on PXA270





Download and Extract The Source Code

- <http://www.mask.org.tw/data/release-sourceforge.tgz>





Download and Extract The Source Code (cont)

- `tar zxvf release-sourceforge.tgz`

```
root@cozyenjoy: ~  
File Edit View Terminal Tabs Help  
root@cozyenjoy:~# ls  
Desktop Music Public Videos release-sourceforge.tgz  
Documents Pictures Templates abc  
root@cozyenjoy:~# tar zxvf release-sourceforge.tgz
```

<http://www.mask.org.tw>



Download and Extract The Source Code (cont)

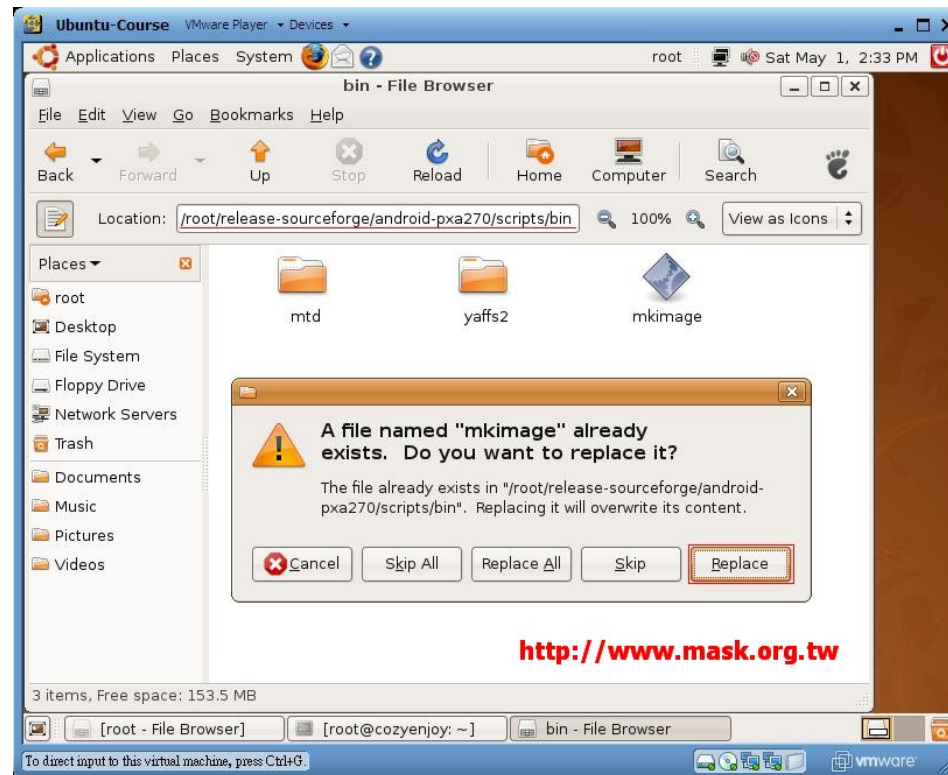
- Done

```
root@cozyenjoy: ~  
File Edit View Terminal Tabs Help  
release-sourceforge/android-pxa270/app/busybox-1.6.1/procps/fuser.c  
release-sourceforge/android-pxa270/app/busybox-1.6.1/loginutils/  
release-sourceforge/android-pxa270/app/busybox-1.6.1/loginutils/sulogin.c  
release-sourceforge/android-pxa270/app/busybox-1.6.1/loginutils/Kbuild  
release-sourceforge/android-pxa270/app/busybox-1.6.1/loginutils/deluser.c  
release-sourceforge/android-pxa270/app/busybox-1.6.1/loginutils/addgroup.c  
release-sourceforge/android-pxa270/app/busybox-1.6.1/loginutils/Config.in  
release-sourceforge/android-pxa270/app/busybox-1.6.1/loginutils/passwd.c  
release-sourceforge/android-pxa270/app/busybox-1.6.1/loginutils/adduser.c  
release-sourceforge/android-pxa270/app/busybox-1.6.1/loginutils/login.c  
release-sourceforge/android-pxa270/app/busybox-1.6.1/loginutils/vlock.c  
release-sourceforge/android-pxa270/app/busybox-1.6.1/loginutils/cryptpw.c  
release-sourceforge/android-pxa270/app/busybox-1.6.1/loginutils/getty.c  
release-sourceforge/android-pxa270/app/busybox-1.6.1/loginutils/su.c  
release-sourceforge/android-pxa270/app/busybox-1.6.1/Makefile.custom  
release-sourceforge/android-pxa270/app/busybox-1.6.1/libpwdgrp/  
release-sourceforge/android-pxa270/app/busybox-1.6.1/libpwdgrp/Kbuild  
release-sourceforge/android-pxa270/app/busybox-1.6.1/libpwdgrp/uidgid_get.c  
release-sourceforge/android-pxa270/app/busybox-1.6.1/libpwdgrp/pwd_grp_internal.  
c  
release-sourceforge/android-pxa270/app/busybox-1.6.1/libpwdgrp/pwd_grp.c  
release-sourceforge/android-pxa270/app/bin/  
release-sourceforge/android-pxa270/.config.cmd http://www.mask.org.tw  
root@cozyenjoy: ~#
```



x86_32

- <http://www.mask.org.tw/data/mkimage>
- Replace release-sourceforge/android-pxa270/scripts/bin/mkimage





x86_32 (cont)

- `chmod +x release-sourceforge/android-pxa270/scripts/bin/mkimage`



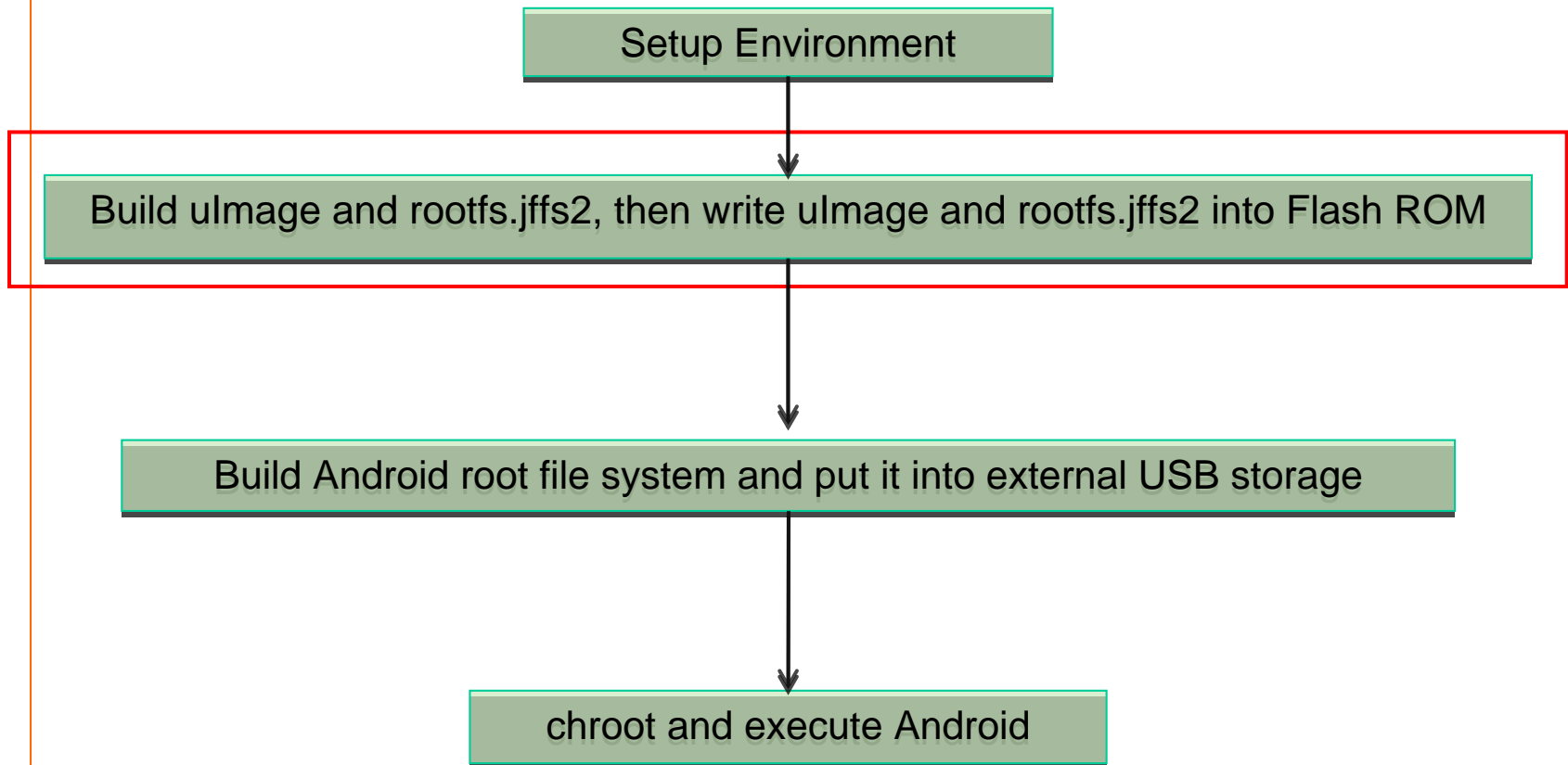
Install Required Packages

- Install zlib1g, libssl and etc.

```
root@rex-desktop:/release-sourceforge/android-pxa270# apt-get install zlib1g-dev libssl-dev
```



Bring Up Android on PXA270

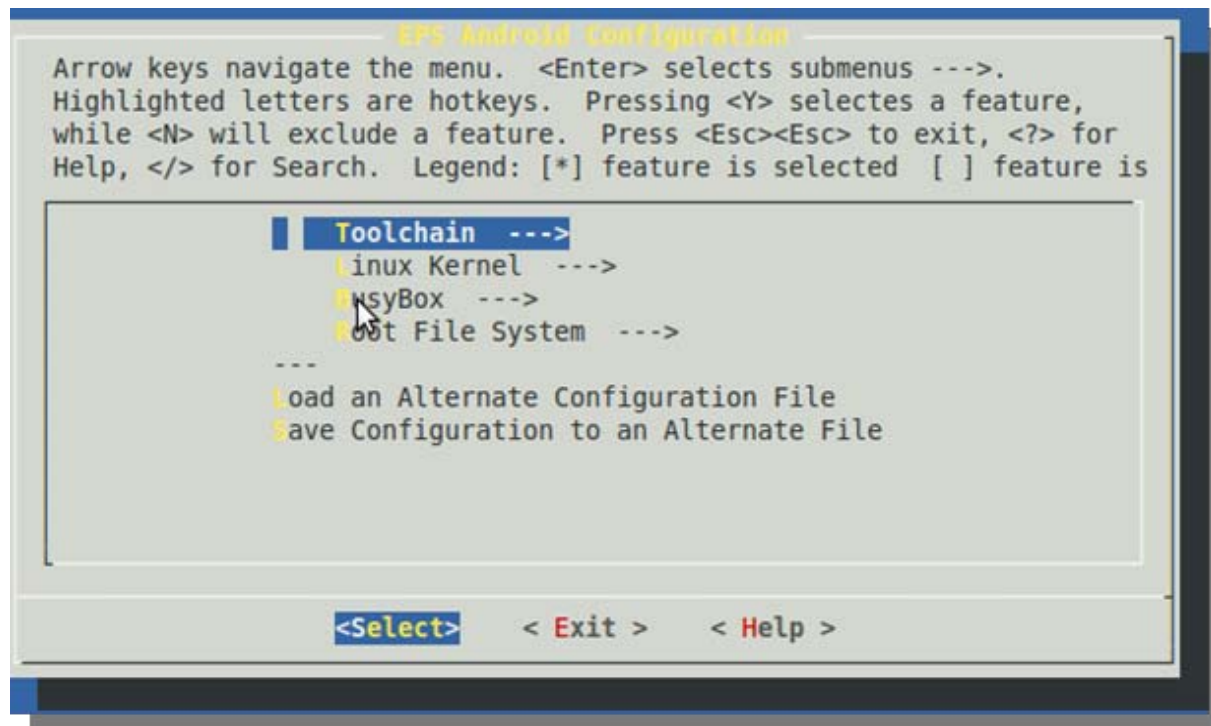




Setup Compiling Options (This step could be ignored)

- "make menuconfig" under release-sourceforge/android-pxa270 directory

```
root@rex-desktop:/release-sourceforge/android-pxa270# make menuconfig
```





Setup Compiling Options (cont)

- Toolchain

```
Using which toolchain
Please enter a string value. Use the <TAB> key to move from the input
field to the buttons below it.
arm-2008q3-41-arm-none-linux-gnueabi-i686-pc-linux-gnu.tar.bz2
```

- Linux Kernel

```
(linux-2.6.25-android-1.0_r1) Android 1.0 SDK, Release 1
```

- BusyBox

```
(busybox-1.13.2) BusyBox 1.13.2
```

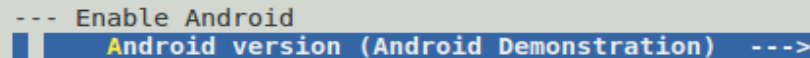
- Root File System

```
(tiny rootfs.tgz) Base Root File System
[*] Enable Android --->
[*] Using JFFS2 Root File System
[ ] Using YAFFS2 Root File System
```

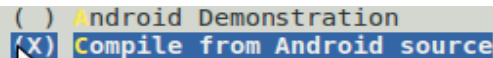


Setup Compiling Options (cont)

- Enable Android
 - Demo
 - Use our pre-build Android root file system directly
- Compile from our modified Android source code



```
--- Enable Android
  Android version (Android Demonstration) --->
```



```
( ) Android Demonstration
(X) Compile from Android source
```

- Save and exit



Do you wish to save your new EPS Android configuration?



< Yes > < No >



Build ulmage and rootfs.jffs2

- sudo and "make"



Build ulmage and rootfs.jffs2 (cont)

- Done

The screenshot shows a VMware Player window titled "Ubuntu-Course" with a terminal window open. The terminal window title is "root@cozyenjoy: ~/release-sourceforge/android-pxa270". The terminal output shows the following:

```
File Edit View Terminal Tabs Help
l 0777 17 0:0 telnetd -> ../../bin/busybox
l 0777 17 0:0 udhcpd -> ../../bin/busybox
/usr/share
/var
d 0777 0 0:0 log
d 0777 0 0:0 run
/var/log
f 0777 1 dmesg
f 0777 188 messages
f 0777 0 utmp
f 0777 0 wtmp
/var/run
f 0777 32 stab
f 0777 0 utmp

Compression mode: priority
Compressors:
none compr: 15 blocks (12635) decomp: 0 blocks
zlib (prio:60) + compr: 297 blocks (667563/1129314) decomp: 0 blocks
rttime (prio:50) + compr: 0 blocks (0/0) decomp: 0 blocks
Compression errors: 0
make[1]: Leaving directory `/root/release-sourceforge/android-pxa270'
root@cozyenjoy:~/release-sourceforge/android-pxa270#
```

A red URL <http://www.mask.org.tw> is displayed in the terminal window. The VMware Player window also shows a file browser at the bottom and a status bar at the bottom with the text "To direct input to this virtual machine, press Ctrl+G."



Build ulmage and rootfs.jffs2 (cont)

- All generated files are under target directory

```
root@rex-desktop:/release-sourceforge/android-pxa270/target# ls
android-demo-rootfs  bin  rootfs
```



Build ulmage and rootfs.jffs2 (cont)

Images which should be written into Flash ROM and external USB storage

```
root@rex-desktop:/release-sourceforge/android-pxa270/target# ls  
android-demo-rootfs  bin  rootfs
```

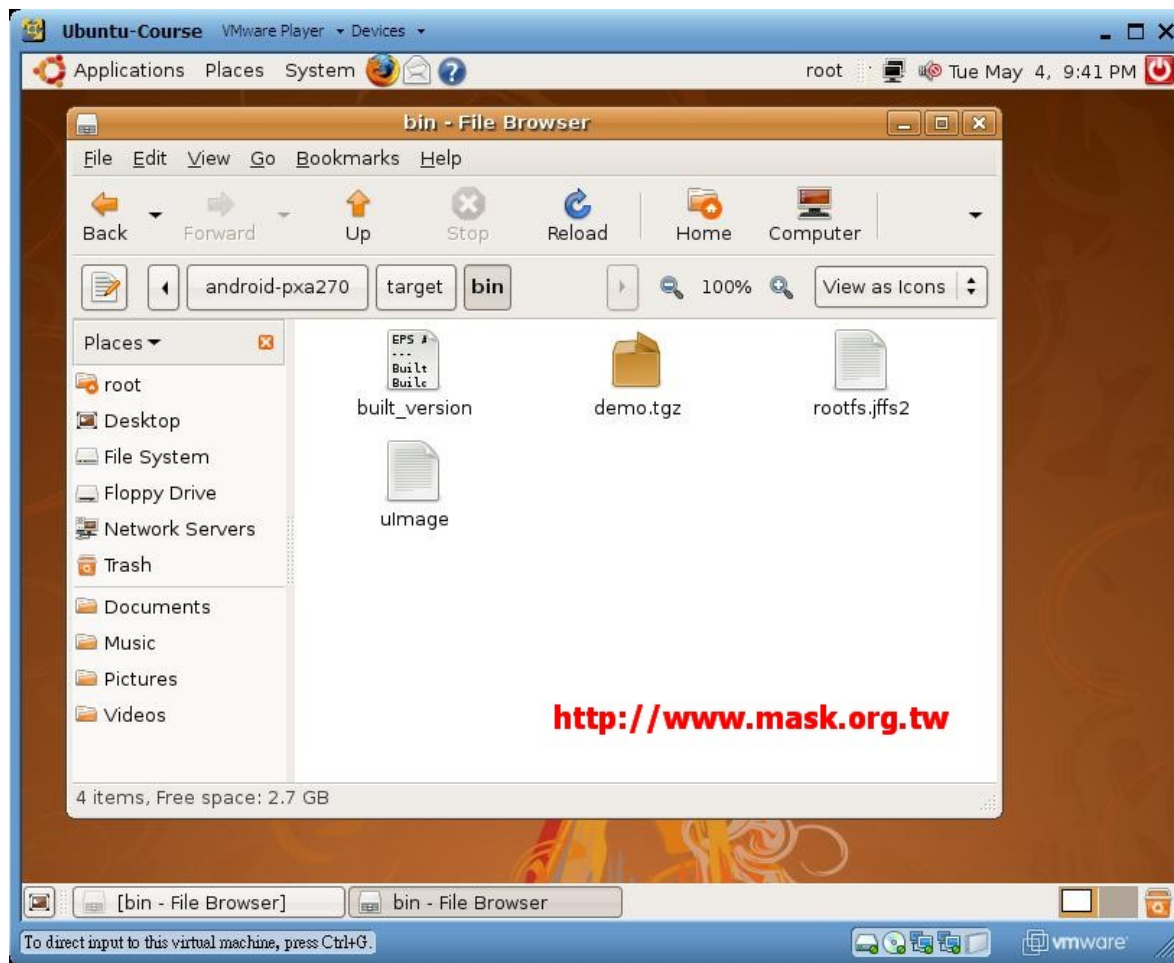
Android root file system

Simple Embedded Linux root file system



Build ulmage and rootfs.jffs2 (cont)

- Under target/bin directory





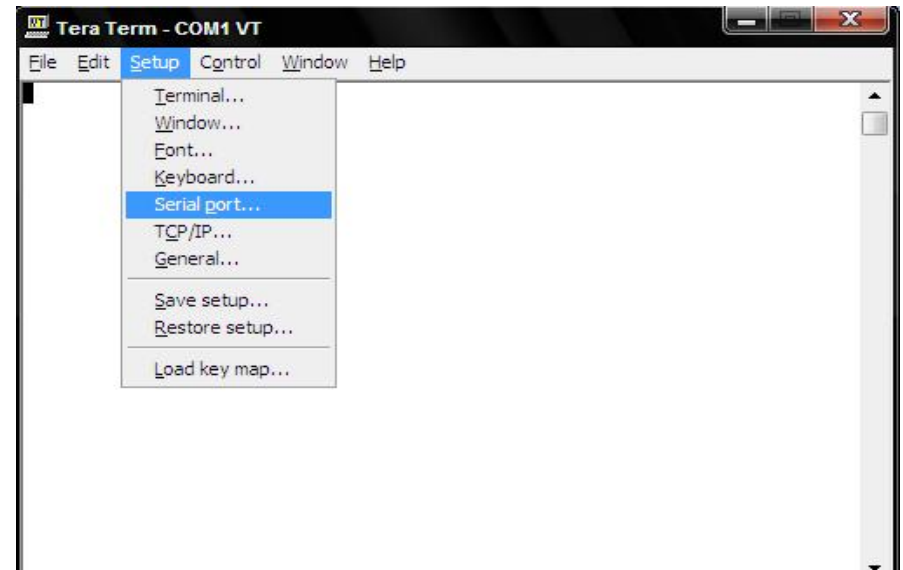
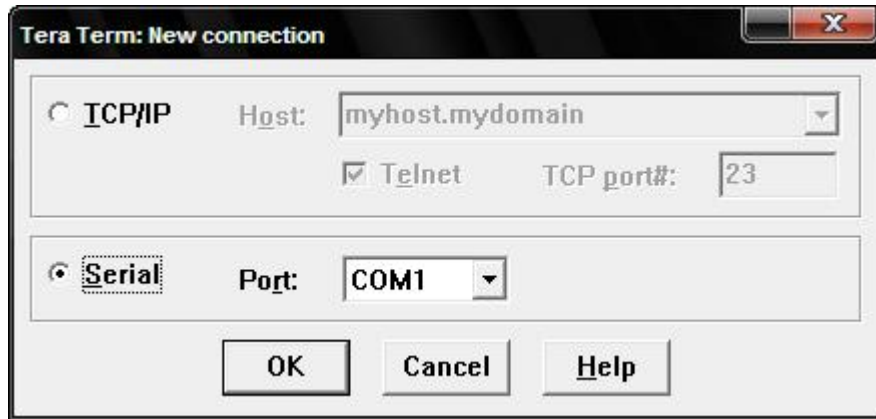
Build ulmage and rootfs.jffs2 (cont)

- demo.tgz is a pre-build Android root file system which should be uncompressed into external USB storage
- rootfs.jffs2 is a simple embedded Linux root file system which should be written into Flash ROM
- ulmage is a Linux kernel image which should be written into Flash ROM



Write ulmage into Flash ROM

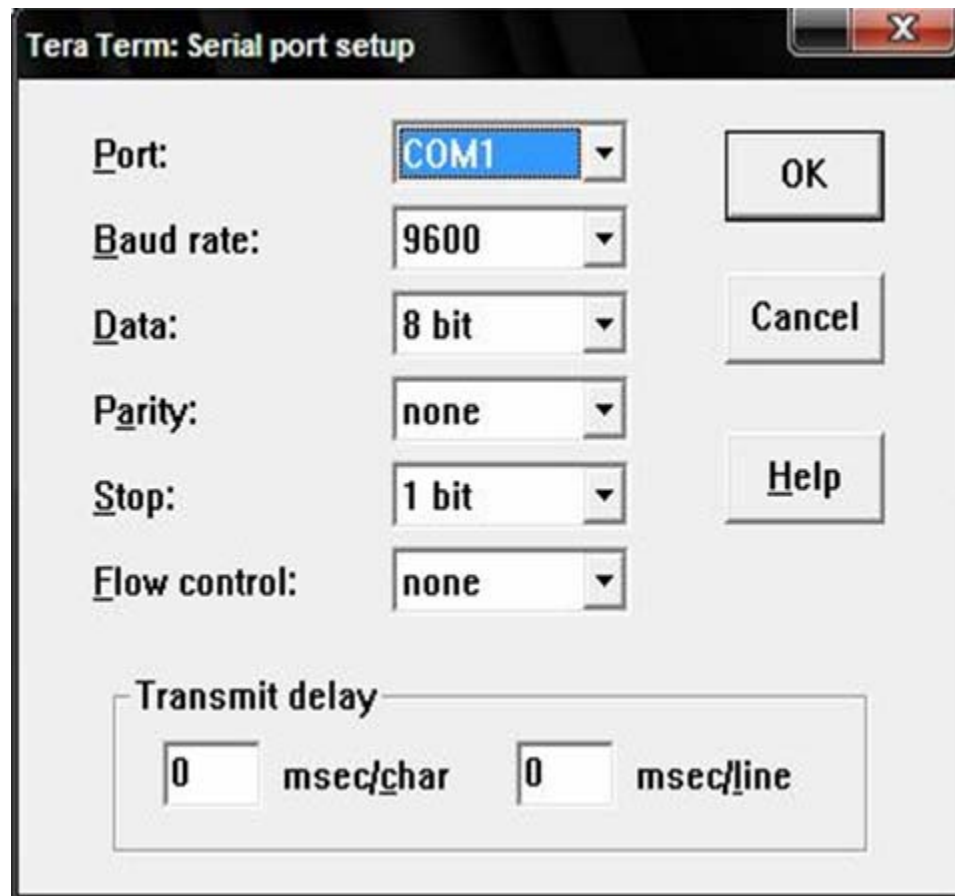
- Setup Tera Term





Write ulmage into Flash ROM (cont)

- Serial port setting





Write ulmage into Flash ROM (cont)

- Power on PXA270 and press any key into u-boot environment

```
Tera Term - COM1 VT
File Edit Setup Control Window Help

U-Boot 1.1.5 (Dec 5 2006 - 12:31:46)

DRAM: 64 MB
Flash: 32 MB
net Envaddr=00:16:08:40:12:05
net HWAddr=00:16:f8:40:12:05
get bootargs=root=/dev/mtdblock3 rw rootfstype=jffs2 console=ttyS0,9600n8 mem=64
M ip=192.168.0.10:192.168.0.153:192.168.0.2:255.255.255.0::eth0:off ether=00:1
6:08:40:12:05
In: serial
Out: serial
Err: serial
Missing Create-PXA270 config block
Hit any key to stop autoboot: 0
u-boot$
```

<http://www.mask.org.tw>



Write ulmage into Flash ROM (cont)

```
RT Tera Term - COM1 VT
File Edit Setup Control Window Help

DRAM: 64 MB
Flash: 32 MB
net Envaddr=00:16:08:40:12:05
net HWAddr=00:16:f8:40:12:05
get bootargs=root=/dev/mtdblock3 rw rootfstype=jffs2 console=ttyS0,9600n8 mem=64
M ip=192.168.0.10:192.168.0.153:192.168.0.2:255.255.255.0::eth0:off ether=00:1
6:08:40:12:05
In: serial
Out: serial
Err: serial
Missing Create-PXA270 config block
Hit any key to stop autoboot: 0
u-boot$ setenv ipaddr 192.168.0.10
u-boot$ setenv serverip 192.168.0.153
u-boot$ saveenv
Saving Environment to Flash...
Un-Protected 1 sectors
Erasing Flash...
Erasing sector 4 ... done
Erased 1 sectors
Writing to Flash... done
Protected 1 sectors
u-boot$
```

輸入Linux Target端的IP

輸入Windows Host端的IP

saveenv 儲存 U-Boot環境變數

<http://www.mask.org.tw>



Write ulmage into Flash ROM (cont)

- Download ulmage into memory on PXA270
- tftp a1100000 ulmage

```
Tera Term - COM1 VT
File Edit Setup Control Window Help
Writing to Flash... done
Protected 1 sectors
u-boot$ <INTERRUPT>
u-boot$
u-boot$
u-boot$
u-boot$
u-boot$ tftp a1100000 uImage

Warning: MAC addresses don't match:
        HW MAC address: 00:16:08:40:12:05
        "ethaddr" value: 00:16:F8:40:12:05
Using MAC Address 00:16:F8:40:12:05
TFTP from server 192.168.0.153; our IP address is 192.168.0.10
Filename 'uImage'.
Load address: 0xa1100000
Loading: #####
done
Bytes transferred = 1860148 (1c6234 hex)
u-boot$
```



Write ulmage into Flash ROM (cont)

- Erase NOR Flash
 - protect off 100000 47ffff
 - erase 100000 47ffff

```
Tera Term - COM1 VT
File Edit Setup Control Window Help
u-boot$ tftp all100000 uImage
Warning: MAC addresses don't match:
        HW MAC address: 00:16:08:40:12:05
        "ethaddr" value: 00:16:F8:40:12:05
Using MAC Address 00:16:F8:40:12:05
TFTP from server 192.168.0.153; our IP address is 192.168.0.10
Filename 'uImage'.
Load address: 0xa1100000
Loading: #####
done
Bytes transferred = 1860148 (1c6234 hex)
u-boot$ protect off 100000 47ffff
Un-Protected 28 sectors
u-boot$ erase 100000 47ffff

Erasing sector 11 ... done
Erasing sector 12 ... done
Erasing sector 13 ... done
```

<http://www.mask.org.tw>



Write ulmage into Flash ROM (cont)

- Write ulmage into NOR Flash on PXA270
- `cp.b a1100000 100000 200000`

```
Tera Term - COM1 VT
File Edit Setup Control Window Help
Erasing sector 19 ... done
Erasing sector 20 ... done
Erasing sector 21 ... done
Erasing sector 22 ... done
Erasing sector 23 ... done
Erasing sector 24 ... done
Erasing sector 25 ... done
Erasing sector 26 ... done
Erasing sector 27 ... done
Erasing sector 28 ... done
Erasing sector 29 ... done
Erasing sector 30 ... done
Erasing sector 31 ... done
Erasing sector 32 ... done
Erasing sector 33 ... done
Erasing sector 34 ... done
Erasing sector 35 ... done
Erasing sector 36 ... done
Erasing sector 37 ... done
Erasing sector 38 ... done
Erased 28 sectors
u-boot$ cp.b a1100000 100000 200000
Copy to Flash...-done
u-boot$
```

<http://www.mask.org.tw>



Write rootfs.jffs2 into Flash ROM

- Download rootfs.jffs2 into memory on PXA270
 - tftp a1480000 rootfs.jffs2

```
VT Tera Term - COM1 VT
File Edit Setup Control Window Help
Erased 28 sectors
u-boot$ cp.b a1100000 100000 200000
Copy to Flash...-done
u-boot$ tftp a1480000 rootfs.jffs2
Using MAC Address 00:18:F8:40:12:05
TFTP from server 192.168.0.153; our IP address is 192.168.0.10
Filename 'rootfs.jffs2'.
Load address: 0xa1480000
Loading:
done
Bytes transferred = 5242880 (500000 hex)
u-boot$
```

<http://www.mask.org.tw>



- [illegible]



Write rootfs.jffs2 into Flash ROM (cont)

- Write rootfs.jffs2 into NOR Flash on PXA270
 - `cp.b a1480000 480000 500000`

```
Tera Term - COM1 VT
File Edit Setup Control Window Help
Erasing sector 56 ... done
Erasing sector 57 ... done
Erasing sector 58 ... done
Erasing sector 59 ... done
Erasing sector 60 ... done
Erasing sector 61 ... done
Erasing sector 62 ... done
Erasing sector 63 ... done
Erasing sector 64 ... done
Erasing sector 65 ... done
Erasing sector 66 ... done
Erasing sector 67 ... done
Erasing sector 68 ... done
Erasing sector 69 ... done
Erasing sector 70 ... done
Erasing sector 71 ... done
Erasing sector 72 ... done
Erasing sector 73 ... done
Erasing sector 74 ... done
Erasing sector 75 ... done
Erasing sector 76 ... done
Erasing sector 77 ... done
Erasing sector 78 ... done
Erased 40 sectors
u-boot$ cp.b a1480000 480000 500000
Copy to Flash...-done
u-boot$
```

<http://www.mask.org.tw>



Boot

```
Tera Term - COM1 VT
File Edit Setup Control Window Help
Bluetooth: BNEP (Ethernet Emulation) ver 1.2
Bluetooth: BNEP filters: protocol multicast
Bluetooth: HIDP (Human Interface Emulation) ver 1.2
RPC: Registered udp transport module.
RPC: Registered tcp transport module.
ieee80211: 802.11 data/management/control stack, git-1.1.13
ieee80211: Copyright (C) 2004-2005 Intel Corporation <jketreno@linux.intel.com>
XScale iWMMXt coprocessor detected.
eth0: link down
IP-Config: Complete:
    device=eth0, addr=192.168.0.10, mask=255.255.255.0, gw=192.168.0.2,
    host=192.168.0.10, domain=, nis-domain=(none),
    bootserver=192.168.0.153, rootserver=192.168.0.153, rootpath=
eth0: link up, 100Mbps, full-duplex, lpa 0x45E1
VFS: Mounted root (jffs2 filesystem).
Freeing init memory: 104K
init started: BusyBox v1.13.2 (2010-04-27 17:23:22 CST)
starting pid 848, tty '': '/etc/init.d/rcS'
starting pid 858, tty '': '/bin/sh'

BusyBox v1.13.2 (2010-04-27 17:23:22 CST) built-in shell (ash)
Enter 'help' for a list of built-in commands.

Processing /etc/profile... Done
[root@Android /]#
```

<http://www.mask.org.tw>

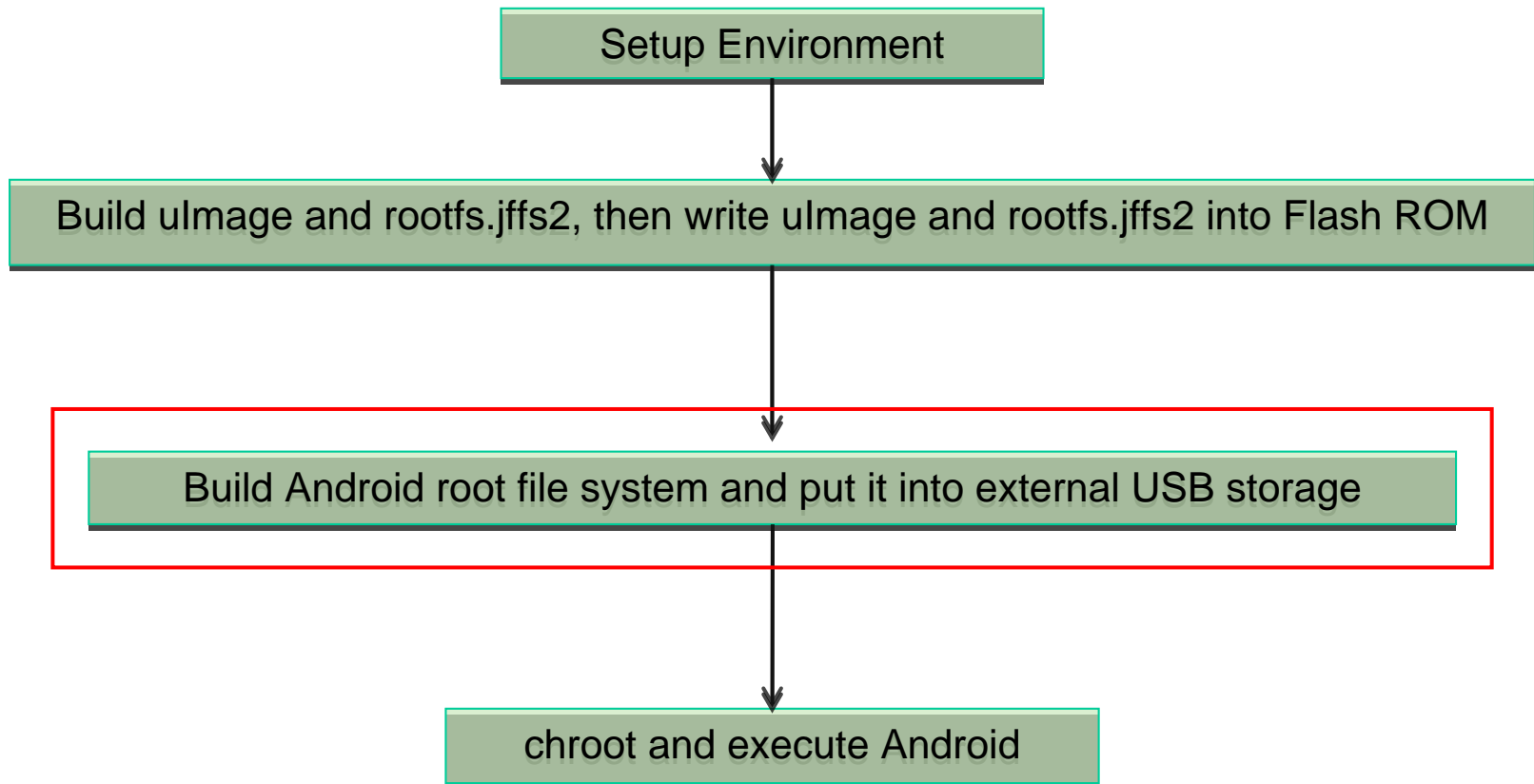


Boot Successfully





Bring Up Android on PXA270





Prepare External USB Storage for Android Root File System

- fdisk -l

```
root@cozyenjoy: ~  
File Edit View Terminal Tabs Help  
root@cozyenjoy:~# fdisk -l  
  
Disk /dev/sda: 42.9 GB, 42949672960 bytes  
255 heads, 63 sectors/track, 5221 cylinders  
Units = cylinders of 16065 * 512 = 8225280 bytes  
Disk identifier: 0x000b56e0  
  
   Device Boot      Start         End      Blocks   Id  System  
/dev/sda1  *           1         2496    20049088+  83  Linux  
/dev/sda2             2497         2610     915705    5  Extended  
/dev/sda3             2611         5221   20972857+  83  Linux  
/dev/sda5             2497         2610     915673+  82  Linux swap / Solaris  
  
Disk /dev/sdb: 2019 MB, 2019557376 bytes  
63 heads, 62 sectors/track, 1009 cylinders  
Units = cylinders of 3906 * 512 = 1999872 bytes  
Disk identifier: 0x1ae53f45  
  
   Device Boot      Start         End      Blocks   Id  System  
/dev/sdb1             1         1009    1970546    b  W95 FAT32  
root@cozyenjoy:~#  
  
http://www.mask.org.tw
```



Prepare External USB Storage for Android Root File System (cont)

- `fdisk /dev/sdb`

```
root@cozyenjoy: ~  
File Edit View Terminal Tabs Help  
/dev/sda2      2497      2610      915705      5      Extended  
/dev/sda3      2611      5221      20972857+   83      Linux  
/dev/sda5      2497      2610      915673+     82      Linux swap / Solaris  
  
Disk /dev/sdb: 2019 MB, 2019557376 bytes http://www.mask.org.tw  
63 heads, 62 sectors/track, 1009 cylinders  
Units = cylinders of 3906 * 512 = 1999872 bytes  
Disk identifier: 0x1ae53f45  
  
   Device Boot      Start         End      Blocks   Id  System  
/dev/sdb1           1         1009      1970546    b   W95 FAT32  
root@cozyenjoy:~# fdisk /dev/sdb  
  
Command (m for help): p  
  
Disk /dev/sdb: 2019 MB, 2019557376 bytes  
63 heads, 62 sectors/track, 1009 cylinders  
Units = cylinders of 3906 * 512 = 1999872 bytes  
Disk identifier: 0x1ae53f45  
  
   Device Boot      Start         End      Blocks   Id  System  
/dev/sdb1           1         1009      1970546    b   W95 FAT32  
Command (m for help):
```



Create An Ext3 Partition

- Command (m for help) : d

```
root@cozyenjoy: ~  
File Edit View Terminal Tabs Help  
Disk /dev/sdb: 2019 MB, 2019557376 bytes  
63 heads, 62 sectors/track, 1009 cylinders  
Units = cylinders of 3906 * 512 = 1999872 bytes  
Disk identifier: 0x1ae53f45  


| Device    | Boot | Start | End  | Blocks  | Id | System    |
|-----------|------|-------|------|---------|----|-----------|
| /dev/sdb1 |      | 1     | 1009 | 1970546 | b  | W95 FAT32 |

  
root@cozyenjoy:~# fdisk /dev/sdb  
  
Command (m for help): p  
  
Disk /dev/sdb: 2019 MB, 2019557376 bytes  
63 heads, 62 sectors/track, 1009 cylinders  
Units = cylinders of 3906 * 512 = 1999872 bytes  
Disk identifier: 0x1ae53f45  


| Device    | Boot | Start | End  | Blocks  | Id | System    |
|-----------|------|-------|------|---------|----|-----------|
| /dev/sdb1 |      | 1     | 1009 | 1970546 | b  | W95 FAT32 |

  
Command (m for help): d  
Selected partition 1  
  
Command (m for help):  
  
http://www.mask.org.tw
```



Create An Ext3 Partition (cont)

- Command (m for help) : p

```
root@cozyenjoy: ~  
File Edit View Terminal Tabs Help  
Command (m for help): p  
  
Disk /dev/sdb: 2019 MB, 2019557376 bytes  
63 heads, 62 sectors/track, 1009 cylinders  
Units = cylinders of 3906 * 512 = 1999872 bytes  
Disk identifier: 0x1ae53f45  
  
   Device Boot      Start         End      Blocks   Id  System  
/dev/sdb1            1          1009      1970546    b   W95 FAT32  
  
Command (m for help): d  
Selected partition 1  
  
Command (m for help): p  
  
Disk /dev/sdb: 2019 MB, 2019557376 bytes  
63 heads, 62 sectors/track, 1009 cylinders  
Units = cylinders of 3906 * 512 = 1999872 bytes  
Disk identifier: 0x1ae53f45  
  
   Device Boot      Start         End      Blocks   Id  System  
  
Command (m for help):
```

<http://www.mask.org.tw>



Create An Ext3 Partition (cont)

```
root@cozyenjoy: ~  
File Edit View Terminal Tabs Help  
Command (m for help): d  
Selected partition 1  
  
Command (m for help): p  
  
Disk /dev/sdb: 2019 MB, 2019557376 bytes  
63 heads, 62 sectors/track, 1009 cylinders  
Units = cylinders of 3906 * 512 = 1999872 bytes  
Disk identifier: 0x1ae53f45  
  
Device Boot      Start         End      Blocks   Id  System  
  
Command (m for help): n  
Command action  
  e   extended  
  p   primary partition (1-4)  
p  
Partition number (1-4): 1  
First cylinder (1-1009, default 1):  
Using default value 1  
Last cylinder or +size or +sizeM or +sizeK (1-1009, default 1009):  
Using default value 1009  
Command (m for help):
```

<http://www.mask.org.tw>



Create An Ext3 Partition (cont)

```
root@cozyenjoy: ~  
File Edit View Terminal Tabs Help  
Device Boot      Start      End      Blocks   Id  System  
  
Command (m for help): n  
Command action  
  e   extended  
  p   primary partition (1-4)  
p  
Partition number (1-4): 1  
First cylinder (1-1009, default 1):  
Using default value 1  
Last cylinder or +size or +sizeM or +sizeK (1-1009, default 1009):  
Using default value 1009  
  
Command (m for help): p  
  
Disk /dev/sdb: 2019 MB, 2019557376 bytes  
63 heads, 62 sectors/track, 1009 cylinders  
Units = cylinders of 3906 * 512 = 1999872 bytes  
Disk identifier: 0x1ae53f45  
  
   Device Boot      Start      End      Blocks   Id  System  
  /dev/sdb1           1      1009     1970546    83   Linux  
  
Command (m for help):
```

<http://www.mask.org.tw>



Create An Ext3 Partition (cont)

- Command (m for help) : w

```
root@cozyenjoy: ~  
File Edit View Terminal Tabs Help  
Last cylinder or +size or +sizeM or +sizeK (1-1009, default 1009):  
Using default value 1009  
  
Command (m for help): p  
  
Disk /dev/sdb: 2019 MB, 2019557376 bytes  
63 heads, 62 sectors/track, 1009 cylinders  
Units = cylinders of 3906 * 512 = 1999872 bytes  
Disk identifier: 0x1ae53f45  
  
   Device Boot      Start         End      Blocks   Id  System  
/dev/sdb1            1         1009      1970546    83   Linux  
  
Command (m for help): w  
The partition table has been altered!  
  
Calling ioctl() to re-read partition table.  
  
WARNING: Re-reading the partition table failed with error 16: Device or resource busy.  
The kernel still uses the old table.  
The new table will be used at the next reboot.  
Syncing disks.  
root@cozyenjoy:~#
```

<http://www.mask.org.tw>



Format USB to Ext3

- `mkfs.ext3 /dev/sdb1`

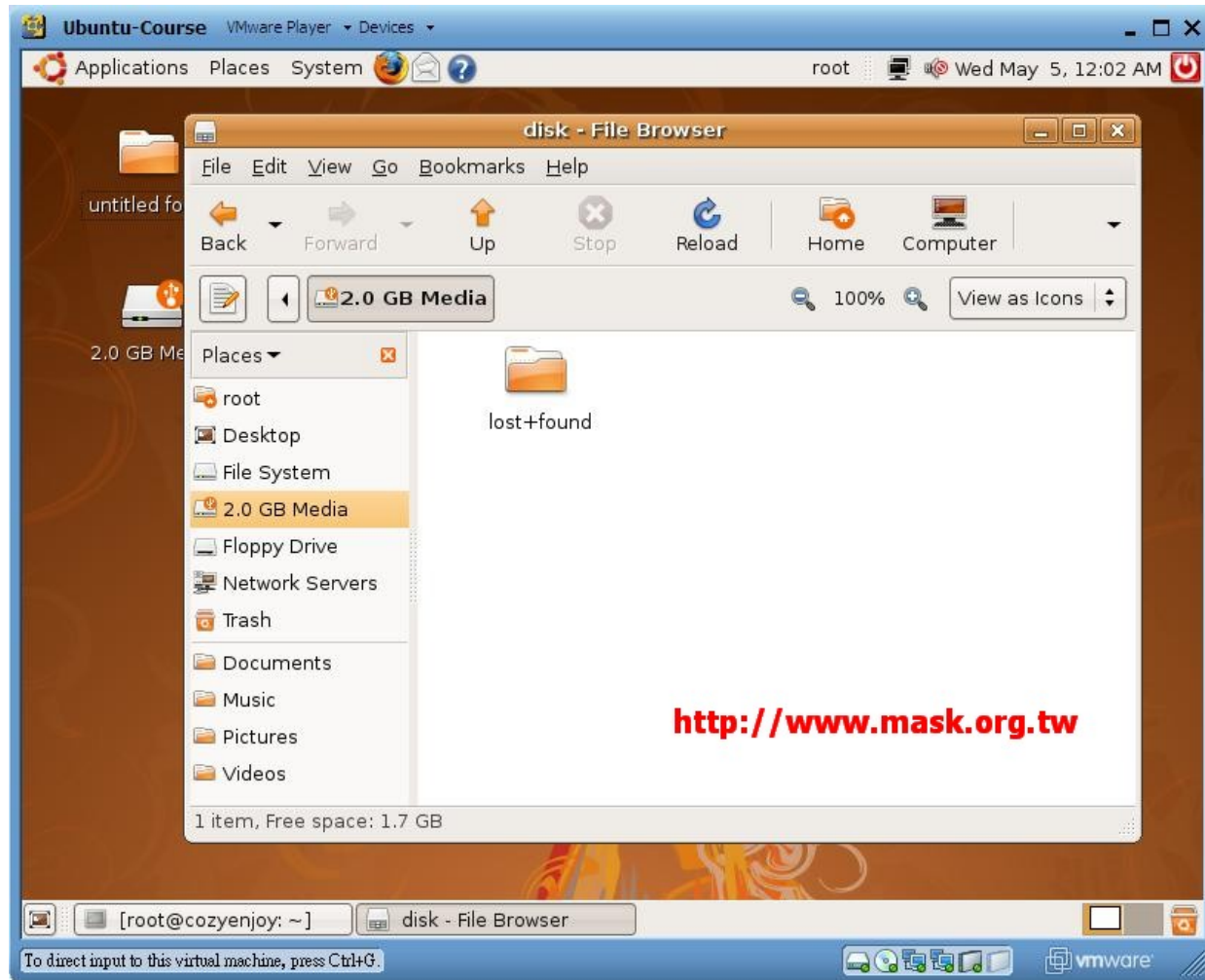
```
root@cozyenjoy: ~  
File Edit View Terminal Tabs Help  
root@cozyenjoy:~# umount /media/disk  
root@cozyenjoy:~# mkfs.ext3 /dev/sdb1  
mke2fs 1.40.8 (13-Mar-2008)  
Filesystem label=  
OS type: Linux  
Block size=4096 (log=2)  
Fragment size=4096 (log=2)  
123392 inodes, 492636 blocks  
24631 blocks (5.00%) reserved for the super user  
First data block=0  
Maximum filesystem blocks=507510784  
16 block groups  
32768 blocks per group, 32768 fragments per group  
7712 inodes per group  
Superblock backups stored on blocks:  
    32768, 98304, 163840, 229376, 294912  
  
Writing inode tables: done  
Creating journal (8192 blocks): done  
Writing superblocks and filesystem accounting information: done  
  
This filesystem will be automatically checked every 31 mounts or  
180 days, whichever comes first. Use tune2fs -c or -i to override.  
root@cozyenjoy:~#
```

<http://www.mask.org.tw>



Extract Pre-build Android Root File System into USB

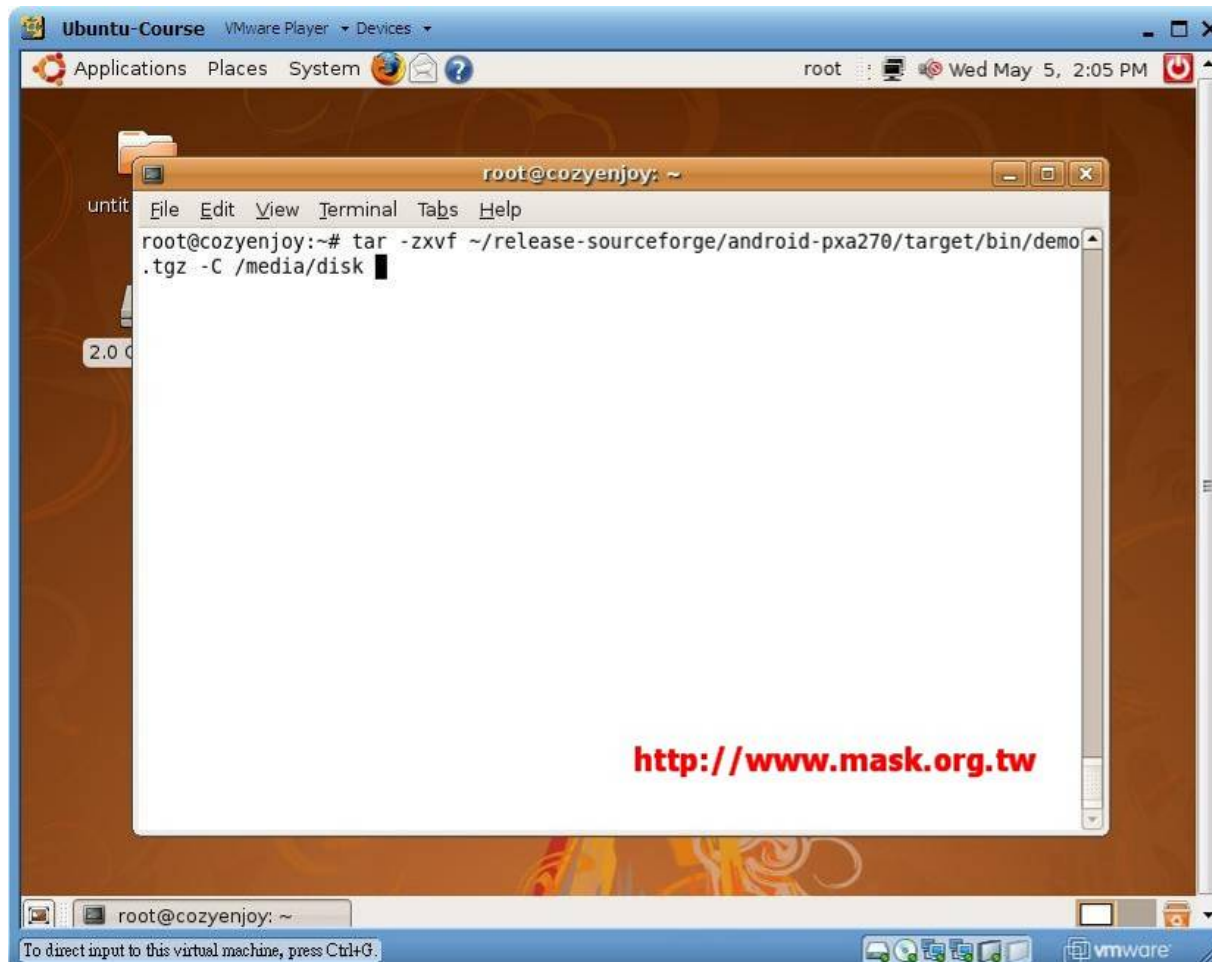
- Mount USB





Extract Pre-build Android Root File System into USB (cont)

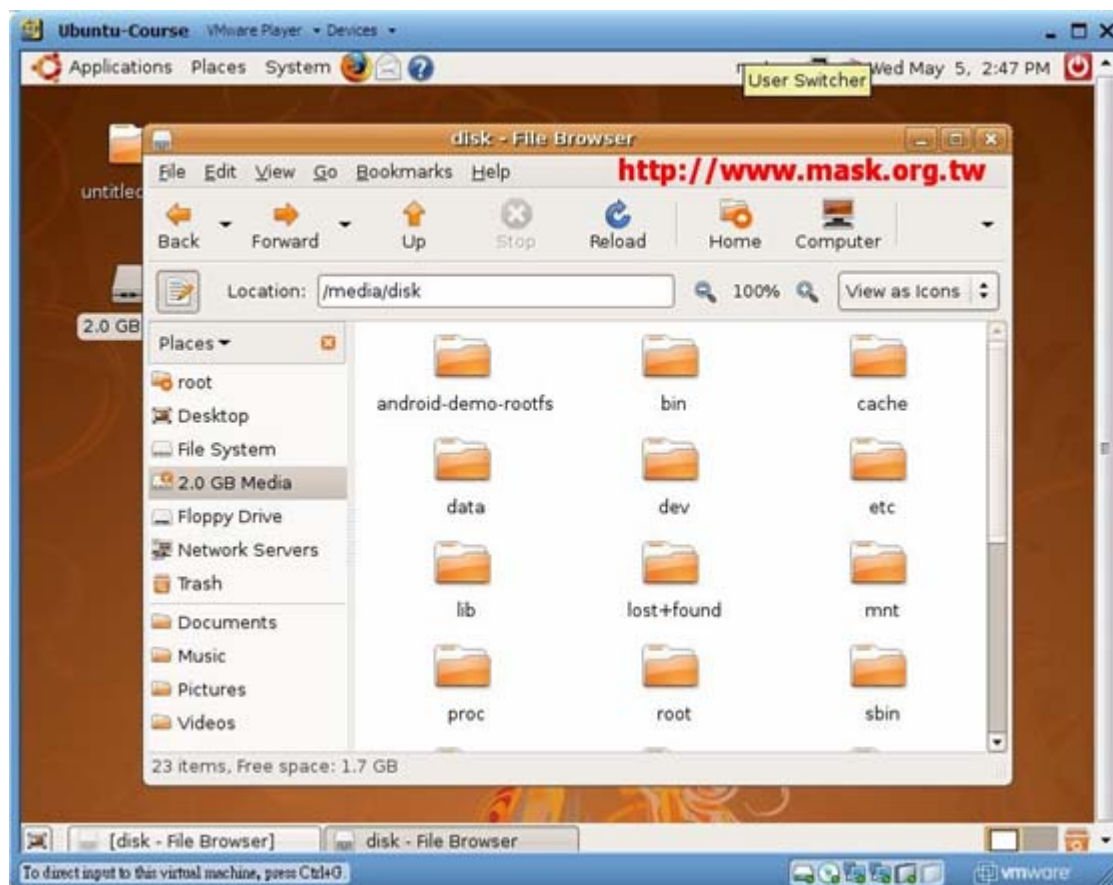
- `tar zxvf target/bin/demo.tgz -C /media/disk`





Extract Pre-build Android Root File System into USB (cont)

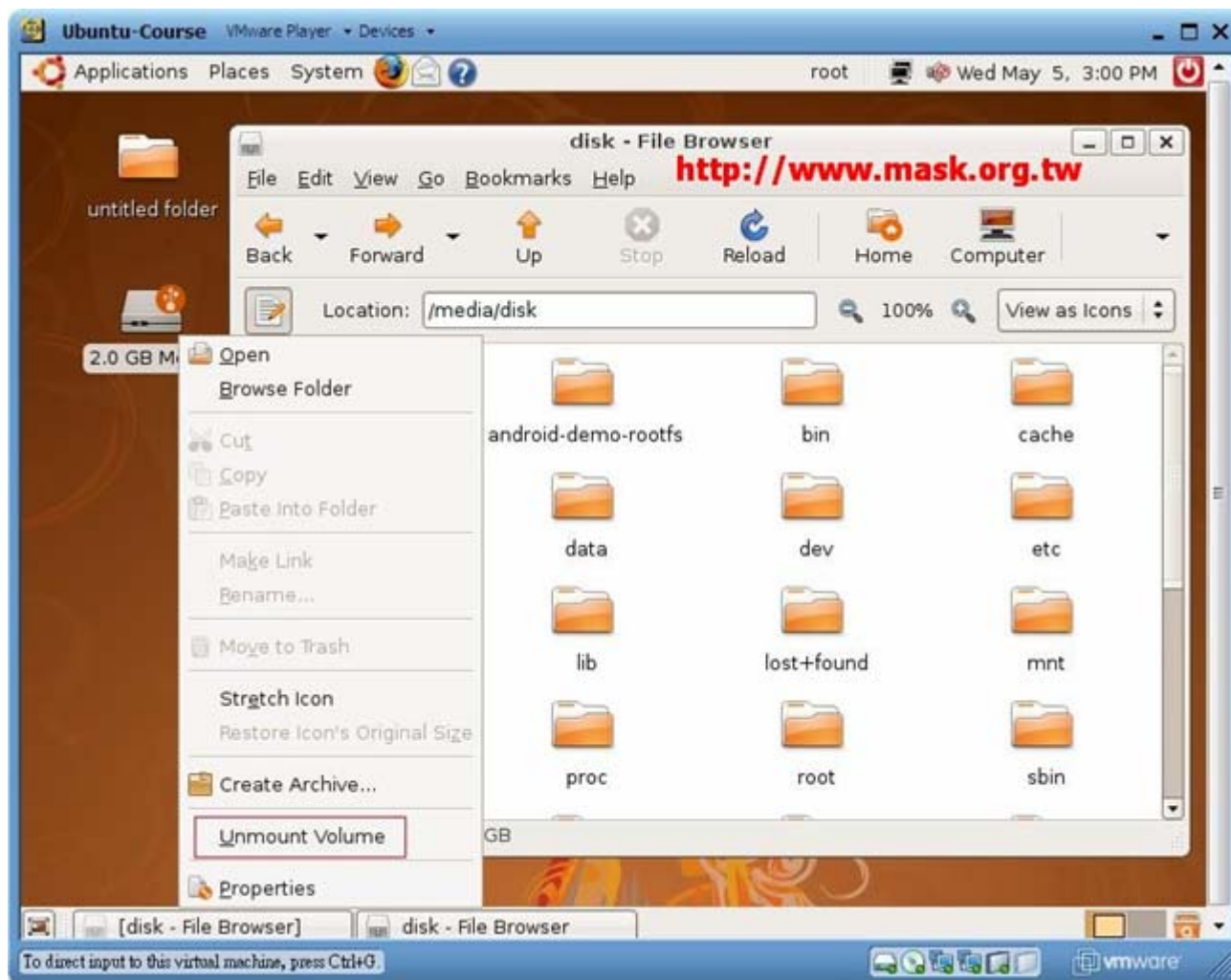
- `cd /media/disk`
- `mv android-demo-rootfs/* .`





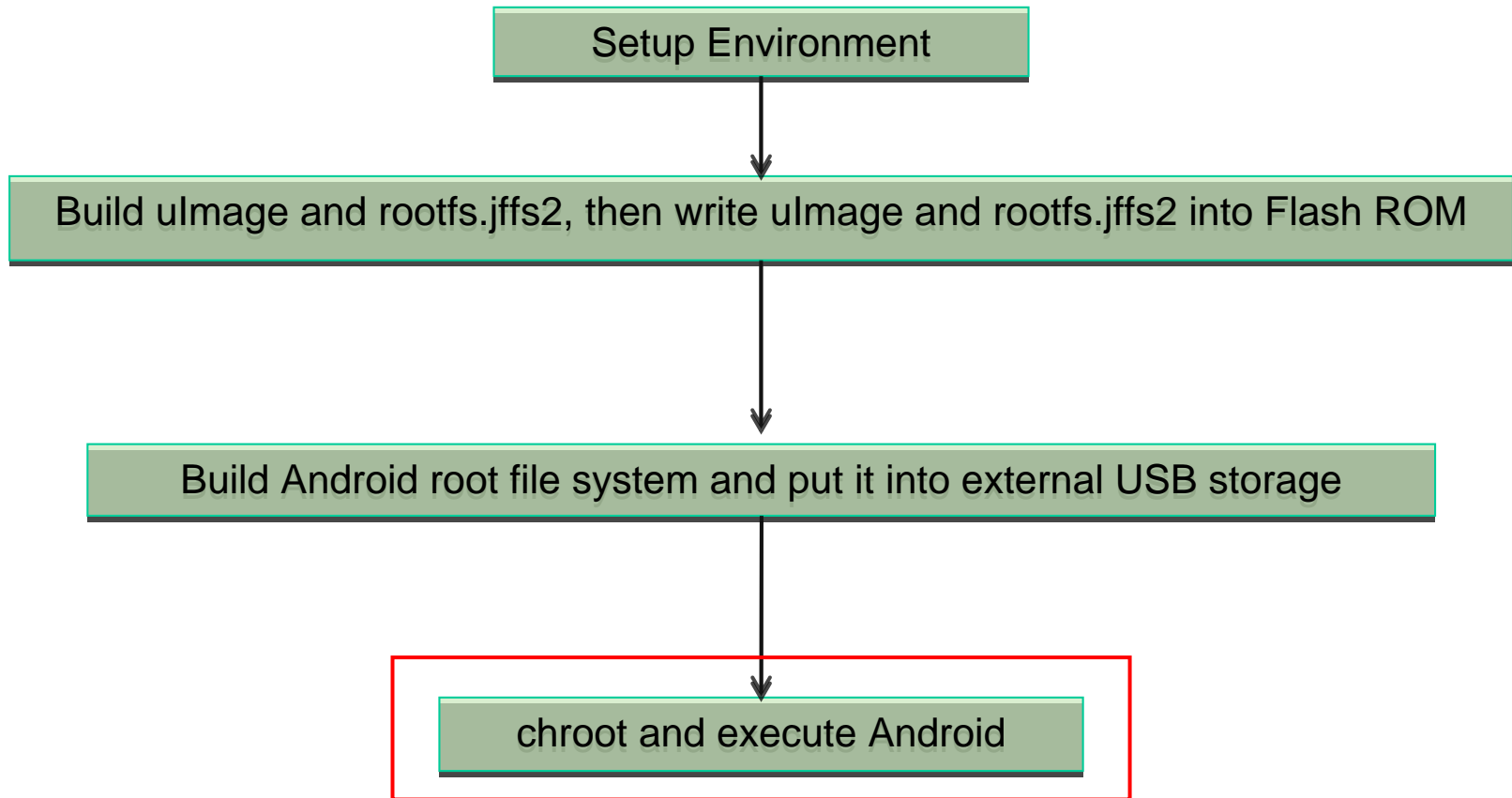
Extract Pre-build Android Root File System into USB (cont)

- Umount USB





Bring Up Android on PXA270





Insert External USB Storage on PXA270

```
Tera Term - COM1 VT
File Edit Setup Control Window Help
Freeing init memory: 104K
init started: BusyBox v1.13.2 (2010-04-27 17:23:22 CST)
starting pid 848, tty '': '/etc/init.d/rcS'
starting pid 858, tty '': '-/bin/sh'
http://www.mask.org.tw
BusyBox v1.13.2 (2010-04-27 17:23:22 CST) built-in shell (ash)
Enter 'help' for a list of built-in commands.

Processing /etc/profile... Done
[root@Android /]#usb 1-1: new full speed USB device using pxa27x-ohci and address 2
usb 1-1: configuration #1 chosen from 1 choice
scsi0 : SCSI emulation for USB Mass Storage devices
scsi 0:0:0:0: Direct-Access JetFlash Transcend 2GB 8.07 PQ: 0 ANSI: 2
sd 0:0:0:0: [sda] 3944448 512-byte hardware sectors (2020 MB)
sd 0:0:0:0: [sda] Write Protect is off
sd 0:0:0:0: [sda] Assuming drive cache: write through
sd 0:0:0:0: [sda] 3944448 512-byte hardware sectors (2020 MB)
sd 0:0:0:0: [sda] Write Protect is off
sd 0:0:0:0: [sda] Assuming drive cache: write through
sda: sda1
sd 0:0:0:0: [sda] Attached SCSI removable disk
sd 0:0:0:0: Attached scsi generic sg0 type 0
[root@Android /]#
```

在這個地方會停住，請按下Enter鍵。



Execute Android

- `cd /tmp`
- `mkdir usb`
- `mount /dev/sda1 ./usb`
- `cd usb`
- `chroot .`
- `./init`



Execute Android (cont)

```
Tera Term - COM1 VT
File Edit Setup Control Window Help
Enter 'help' for a list ofsd 0:0:0:0: [sda] Assuming drive cache: write through
built-in commands.

http://www.mask.org.tw

Processing /etc/profile... sda:Done
[root@Android /]# sda1
sd 0:0:0:0: [sda] Attached SCSI removable disk
sd 0:0:0:0: Attached scsi generic sg0 type 0

[root@Android /]#cd /tmp
[root@Android /tmp]#mkdir usb
[root@Android /tmp]#mount /dev/sda1 ./usb
kjournald starting. Commit interval 5 seconds
EXT3 FS on sda1, internal journal
EXT3-fs: recovery complete.
EXT3-fs: mounted filesystem with ordered data mode.
[root@Android /tmp]#cd usb
[root@Android usb]#chroot .

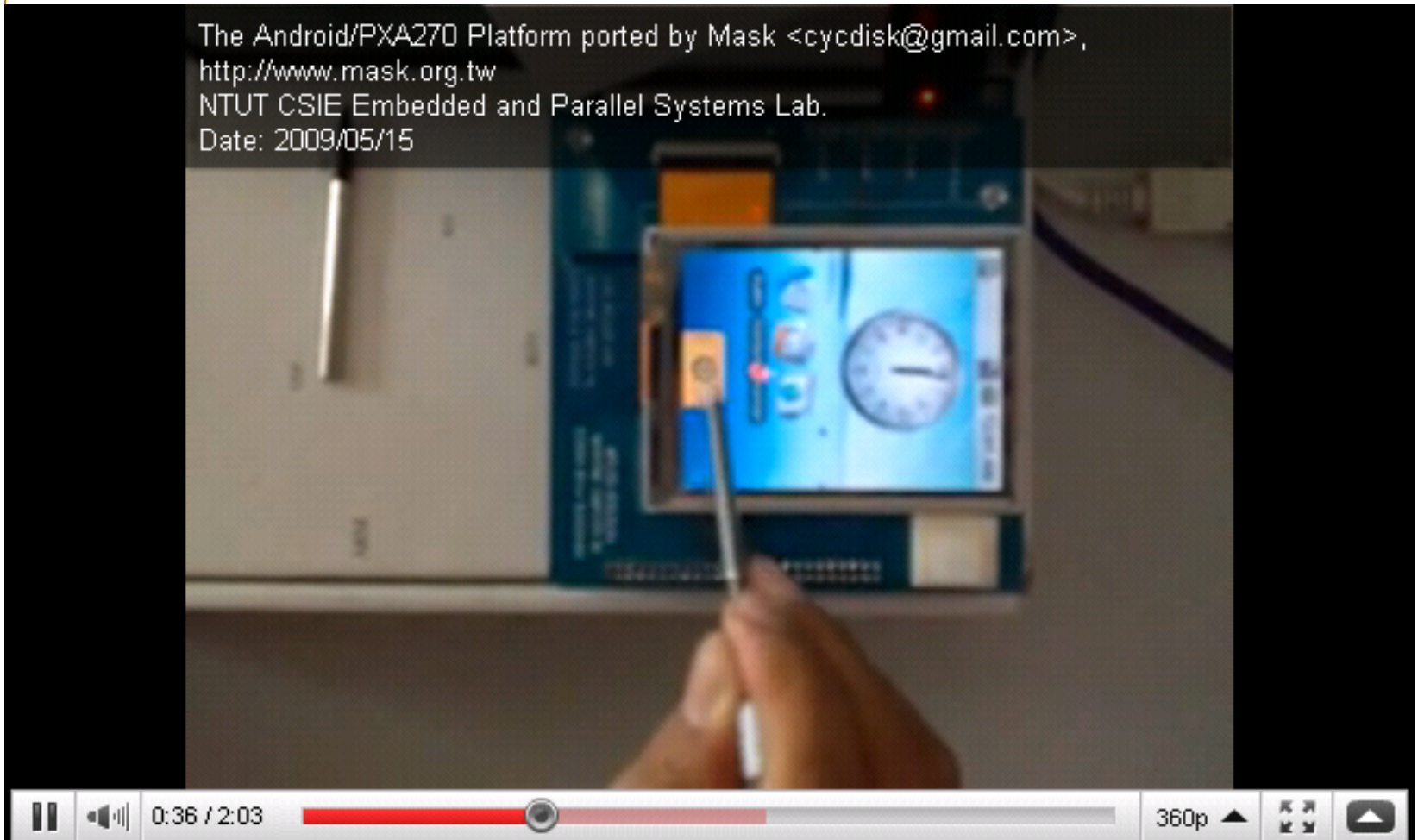
BusyBox v1.13.2 (2009-03-03 01:05:13 CST) built-in shell (ash)
Enter 'help' for a list of built-in commands.

[root@Android /]#./init
init: cannot open '/initlogo.rle'
init: cannot find '/system/bin/playmp3', disabling 'boot sound'
sh: can't access tty; job control turned off
# warning: `app_process' uses 32-bit capabilities (legacy support in use)
```



Execute Android (cont)

- <http://www.youtube.com/watch?v=IYzRSNuUslw>





Keypad Layout

1 (KEY_BACK)	2 (KEY_UP)	3 (KEY_RESERVED)	A (KEY_MENU)
4 (KEY_LEFT)	5 (KEY_RESERVED)	6 (KEY_RIGHT)	B (KEY_HOME)
7 (KEY_RESERVED)	8 (KEY_DOWN)	9 (KEY_RESERVED)	C (KEY_BACKSPACE)
* (KEY_LEFTSHIFT)	0 (KEY_RESERVED)	# (KEY_RESERVED)	D (KEY_SPACE)



Reference

- 2009/7, Android 1.0 source code for PXA270
 - <http://www.mask.org.tw/data/release-sourceforge.tgz>
- Wen-Chang Chung, "The Study and Implementation of Operating System Porting for Android", NTUT CSIE, 2009
 - http://www.mask.org.tw/data/Android_Porting.pdf



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Q & A