ESTR 3102

Gentoo Installation and Kernel Compilation

Helen Chan
SHB 118
hwchan@cse.cuhk.edu.hk
Office Hours: Fri 10am-12pm, or by appointment

Thanks to Dr. Q. Huang and Dr. T.Y. Wong for their slides :)

Outline

• Pre-installation

• Installation
  1. Boot from Gentoo installation CD
  2. Prepare the disk partitions
  3. Prepare the base system

• Kernel Compilation
  1. Get kernel source and configure kernel options
  2. Compile kernel
  3. Set up the new system

• Reference
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Pre-installation

• Tools to host a virtual machine (VM)
  ▫ e.g. VirtualBox, VMware Player

• Gentoo installation image (iso)

• Enable VT-x for Intel CPU
  ▫ An option available in BIOS (if CPU supports VT-x)
    ▪ Disabled by default (as far as I know ... )
  ▫ Required for running 64-bit VMs
Pre-installation

1. Create a new VM
   - For VMware, choose “I will install the operating system later” at the first step
   - Size of Hard Disk: no less than 12GB

2. Edit VM setting
   - Select the Gentoo CD image for CD-drive
3. Prepare the resource USB

- Download and place the following files into the top-most directory of your USB
  - Stage tarball: [http://goo.gl/YxTj8P](http://goo.gl/YxTj8P)
  - Portage tarball: [http://goo.gl/FPma4v](http://goo.gl/FPma4v)
  - Kernel configuration file (VirtualBox): [http://www.cse.cuhk.edu.hk/~hwchan/estr/config-vbox](http://www.cse.cuhk.edu.hk/~hwchan/estr/config-vbox)
- Around 375 MB in total
  - (File size in Bytes)
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Step 1. Boot from Gentoo CD

- Boot VM from CD
  - Press “Enter” when the VM boots up
  - Press “Enter” to use default keyboard setting
Step 1. Boot from Gentoo CD

- Boot VM from CD
  - After pressing “Enter” twice,
Step 2. Prepare Disk Partitions

• Show hard disk information

```
livedc ~ # fdisk -l /dev/sda
```

Disk /dev/sda: 12 GiB, 12884901888 bytes, 25165824 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

```
livedc ~ # 
```

• Disk partition plan

<table>
<thead>
<tr>
<th>Partition</th>
<th>File System</th>
<th>Size</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/sda1</td>
<td>(.boot loader)</td>
<td>2MB</td>
<td>BIOS boot</td>
</tr>
<tr>
<td>/dev/sda2</td>
<td>ext2</td>
<td>128MB</td>
<td>Gentoo boot</td>
</tr>
<tr>
<td>/dev/sda3</td>
<td>(swap)</td>
<td>1024MB</td>
<td>Swap partition</td>
</tr>
<tr>
<td>/dev/sd4</td>
<td>ext4</td>
<td>All the rest</td>
<td>Root</td>
</tr>
</tbody>
</table>
Step 2. Prepare Disk Partitions

1. Create the partitions (first two partitions)

```
livecd ~ # fdisk /dev/sda

Welcome to fdisk (util-linux 2.25.2).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Device does not contain a recognized partition table.
Created a new DOS disklabel with disk identifier 0x35065ef.

Command (m for help): n
Partition type
  p  primary (0 primary, 1 extended, 4 free)
  e  extended (contains logical partitions)
Select (default p): p
Partition number (1-4, default 1): +2M
First sector (2048-25165823, default 2048):
Last sector, +sectors or +size(K,M,G,T,P) (2048-25165823, default 25165823): +2M

Created a new partition 1 of type 'Linux' and of size 2 MiB.

Command (m for help): n
Partition type
  p  primary (1 primary, 1 extended, 3 free)
  e  extended (contains logical partitions)
Select (default p): p
Partition number (2-4, default 2):
First sector (6144-25165823, default 6144):
Last sector, +sectors or +size(K,M,G,T,P) (6144-25165823, default 25165823): +128M

Created a new partition 2 of type 'Linux' and of size 128 MiB.
```
Step 2. Prepare Disk Partitions

1. Create the partitions (last two partitions)

Command (m for help)

n

Partition type

p  primary (2 primary, 0 extended, 2 free)
  e  extended (container for logical partitions)
Select (default p): p
Partition number (3, 4, default 3):
First sector (268288-25165823, default 268288):
Last sector, +sectors or +size{k,M,G,T,P} (268288-25165823, default 25165823):
P   n

Press “Enter”

+1024M

Created a new partition 3 of type 'Linux' and of size 1 GiB.

Command (m for help): n

Partition type

p  primary (3 primary, 0 extended, 1 free)
  e  extended (container for logical partitions)
Select (default e): p

Selected partition 4
First sector (2365440-25165823, default 2365440):
Last sector, +sectors or +size{k,M,G,T,P} (2365440-25165823, default 25165823):
P

Press “Enter”

+1024M

Created a new partition 4 of type 'Linux' and of size 10.9 GiB.

Command (m for help): w

The partition table has been altered.
Calling ioctl() to re-read partition table.
Syncing disks.

w (Confirm and write the partition table to disk !!)
Step 2. Prepare Disk Partitions

2. Mark the partitions

```
livecd ~ # fdisk /dev/sda
Welcome to fdisk (util-linux 2.25.2).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Command (m for help): t
Partition number (1-4, default 4): 1
Hex code (type L to list all codes): ef
Changed type of partition '1' to 'EFI (FAT-12/16/32)'.

Command (m for help): a
Partition number (1-4, default 4): 2
The bootable flag on partition 2 is enabled now.

Command (m for help): t
Partition number (1-4, default 4): 3
Hex code (type L to list all codes): 82
Changed type of partition 'Linux' to 'Linux swap / Solaris'.

Command (m for help): w
The partition table has been altered.
Calling ioctl() to re-read partition table.
Syncing disks.
```
Step 2. Prepare Disk Partitions

3. Outcome

```
livedc ~ # fdisk -l /dev/sda

Disk /dev/sda: 12 GiB, 12884901888 bytes, 25165824 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x350651ef

Device Boot Start  End   Sectors Size Id Type
/dev/sda1    2048  6143  4096  2M ef EFI (FAT-12/16/32)
/dev/sda2    *  6144 268287 262144 128M 83 Linux
/dev/sda3 268288 2365439 2097152 1G 82 Linux swap / Solaris
/dev/sda4 2365440 25165823 22800384 10.9G 83 Linux
```

(it is alright to be different)
Step 2. Prepare Disk Partitions

4. Create file systems
   - # mkfs.ext2 /dev/sda2
   - # mkfs.ext4 /dev/sda4
   - # mkswap /dev/sda3

5. Enable swap
   - # swapon /dev/sda3

6. Mount file systems
   - # mount /dev/sda4 /mnt/gentoo
   - # mkdir /mnt/gentoo/boot
   - # mount /dev/sda2 /mnt/gentoo/boot
Step 3. Prepare the Base System

1. Mount the resource USB
   - Connect USB
     - For VMware, at the top right-hand corner
     - For VirtualBox, at the bottom right-hand corner
     - Make sure the resource usb is the ONLY usb connected to the VM
   - `# mkdir /mnt/usb`
   - `# mount /dev/sdb1 /mnt/usb`
   - `# ls /mnt/usb`

   ![VMware USB connection](image1.png)
   ![VirtualBox USB connection](image2.png)
Step 3. Prepare the Base System

2. Extract the stage tarball
   - # cd /mnt/gentoo
   - # tar xjpf /mnt/usb/stage3.tar.bz2

3. Mount (special) file systems
   - # mount -t proc proc /mnt/gentoo/proc
   - # mount --rbind /sys /mnt/gentoo/sys
   - # mount --rbind /dev /mnt/gentoo/dev

4. Enter the new environment
   - # chroot /mnt/gentoo /bin/bash
   - # source /etc/profile
   - # export PS1="(chroot) $PS1"

(chroot) /livecd/ #
Step 3. Prepare the Base System

5. Mount the resource USB (again)
   - # mkdir /mnt/usb
   - # mount /dev/sdb1 /mnt/usb

6. Extract portage tarball
   - # tar xjf /mnt/usb/portage.tar.bz2 -C /usr
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Step 1. Get Src. and Config. Kernel

1. Get kernel source code
   - `# emerge gentoo-sources`

2. Configure kernel options
   - `# cd /usr/src/linux`
   - EITHER manually configure the options
     - `# make menuconfig`
     - (press “Enter” to jump to menu, press “Space” to change an option)
     - Configure based on Reference
   - OR copy the configure file
     - For VMware, `# cp /mnt/usb/config-vmware .config`
     - For VirtualBox, `# cp /mnt/usb/config-vbox .config`
Step 2. Compile Kernel

1. Compile and install
   - # make
   - # make install
   - # make modules_install
Step 3. Set up the New System

1. Set up grub bootloader
   - # emerge sys-boot/grub
   - # grub2-install /dev/sda
   - # grub2-mkconfig -o /boot/grub/grub.cfg

2. Set up root password
   - # passwd
Step 3. Set up the New System

3. Set up /etc/fstab
   - # nano /etc/fstab

```
#<fs>     <mountpoint>  <type>         <opts>                     <dump/pass>
# NOTE: If your BOOT partition is ReiserFS, add the notail option to opts.
/dev/sda2  /boot    ext2           defaults,noatime   0 2
/dev/sda4  /        ext4           noatime        0 1
/dev/sda3  none     swap           noatime        0 0
/dev/cdrom /mnt/cdrom auto       noauto,ro      0 0
/dev/fd0   /mnt/floppy auto       noauto        0 0
```

- Press “Ctrl + x”, “y” and “Enter” to save and exit
Step 3. Set up the New System

4. Set up the network
   - # cd /etc/init.d/
   - For VirtualBox,
     - # ln -s net.lo net.enp0s3
     - # rc-update add net.enp0s3
   - For VMware,
     - # ln -s net.lo net.eno16777736
     - # rc-update add net.eno16777736
   - Reboot!
     - # reboot
   - Login as “root”
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Reference

• Gentoo Handbook

• Gentoo HK Mirror
  ▫ http://gentoo.aditsu.net:8000/
  ▫ “release” : CD images and stage tarballs
  ▫ “snapshots”: portage tarballs

• Kernel Options
  ▫ [VMware] https://forums.gentoo.org/viewtopic-t-961502.html
Appendix

If you power off the machine just before kernel compilation, do the following steps before resuming the compilation:

- **Installation:** Enable swap and mount file systems: Step 2.5-2.6
- **Installation:** Mount (special) file systems and enter the new environment: Step 3.3-3.4
Appendix

• For VMware,
  ▫ To get more time for entering BIOS or boot menu, add the following option to the end of “.vmx” file after power off
    ▪ bios.bootDelay = "5000"
  ▫ This option tells the player to delay for 5 seconds before booting from the default device
  ▫ This will be useful when hard disk is bootable but you want to boot from other devices, e.g. CD, removable drives