TITLE: INSTALLING, BOOTING AND RECOVERING WITH GRUB

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Booting Basics
- What is grub?
  - A boot loader
- What does a boot loader do?
  - It loads boot code (and kernel) for the computer
- What's boot code?
  - BIOS
  - MBR
  - stage1
  - *_stage1_5
  - stage2
  - kernel
  - initrd (optional) (INITial Ram Disk)
- What's in the MBR?
  - 0x0000-0x01BD Code (446 bytes)
    - Stage 1 code to load stage2 code
  - 0x01BE-0x01CD Partition 1 (16 bytes)
  - 0x01CE-0x01DD Partition 2 (16 bytes)
  - 0x01DE-0x01ED Partition 3 (16 bytes)
  - 0x01EE-0x01FD Partition 4 (16 bytes)
  - 0x01FE-0x01FF Signature (2 bytes, 0xAA55)
- What what is the other famous boot loader for Linux?
  - LILO
- What is the root difference between grub and Lilo?
  - Grub can read the filesystem
- What are the consequential differences?
  - Grub doesn't require running a program after config file change
  - Grub's config file describes after-boot conditions
  - Grub has an interactive interface
  - Grub can find and file completion
  - Grub allows interactive switch of config file
  - Grub works only with filesystems it can read

- Grub basics
  - Boot file sequence
    - BIOS
    - MBR (hard drive, floppy or bootable CD) (Grub stage1)
    - grub *_stage1_5 (optional)
    - grub stage2
    - Kernel (possibly assisted by initrd)
    - init
  - Boot action sequence (no config file)
    - /* Power on or reboot */
    - root (hd0,5) #means /dev/hda6)
    - kernel /boot/vmlinuz root /dev/hda6
    - initrd /boot/initrd-whatever
    - boot
  - Gotchas
    - grub executable and stage1/2 are a package deal
    - Need for initrd is intermittent
    - Watch out for separate /boot partitions
  - Documentation at http://www.gnu.org/software/grub/manual/
  - Grub legacy vs grub 2
    - This presentation’s on grub legacy
    - Grub 2 isn’t ready for prime time
    - Grub 2 is a complete rewrite
      - Smaller memory image
      - Runtime code loading
      - No need for *_stage1_5
      - Scripting language for greater extensibility

- Booting from a grub menu
  - Make your selection
  - If necessary, go into command mode with c keystroke
- Booting from a grub prompt
  - Grub as an investigation tool
    - The find command and file completion
  - Pulling up a menu
    - configfile (hd0,7)/menu.lst
  - Using the Kernel
    - root (hd0,0)
      - location of the /boot directory
    - kernel /vmlinuz-whatever root=/dev/hda7
      - vmlinuz-whatever is kernel in the /boot dir
      - root= is location of the init executable
    - initrd /initrd-whatever
      - initrd-whatever is the initrd file, sometimes needed
    - boot
      - Completes the boot
  - Using kernel with separate /boot partition (hda9=/, hda1=/boot)
    - root (hd0,0)
    - kernel /vmlinuz-whatever root=/dev/hda9
    - initrd /initrd-whatever

Creating a Grub Floppy
- Simple Grub Floppy
  - cat stage1 stage2 > /dev/fd0u1440
  - reboot
  - At the grub prompt
    - Select a config file or
    - Select root, kernel with root
      - and if necessary initrd
- Complete Grub Floppy
  - mkfs.ext2 -c /dev/fd0u1440
  - mkdir /mnt/test
  - mount /dev/fd0u1440 /mnt/test
  - cp -i /sbin/grub /boot/grub/
    - Matching grub executable packaged with its stage1 and stage2
  - cd /boot/grub
  - mkdir -p /mnt/test/boot/grub/menu
  - cp stage1 /mnt/test/boot/grub
  - cp stage2 /mnt/test/boot/grub
  - chmod a-w /mnt/test/boot/grub/stage*
  - cp -i /mnt/test/boot/grub
  - Optional: rm /mnt/test/boot/grub/menu.lst
  - cp menu.lst /mnt/test/boot/grub/
  - chmod a-w /mnt/test/boot/grub/*
  - umount /dev/fd0u1440
  - cd /boot/grub
  - ./grub
    - root (fd0)
    - setup (fd0)
    - quit
  - reboot

Creating a grub CD the right way (stage2_eltorito)

```
mkdir -p ~/grub_build/boot/grub
cp -p /boot/grub/stage1 ~/grub_build/boot/grub/
cp -p /boot/grub/stage2 ~/grub_build/boot/grub/
cp -p /boot/grub/stage2_eltorito ~/grub_build/boot/grub/
cp -p /boot/grub/*_stage1_5 ~/grub_build/boot/grub/
cp -p /boot/grub/menu.lst ~/grub_build/boot/grub/ #optional
cp -p /sbin/grub ~/grub_build/boot/grub/
cp -p /sbin/grub-install ~/grub_build/boot/grub/
cd ~
mkisofs -R -b boot/grub/stage2_eltorito -no-emul-boot \
    -boot-load-size 4 -boot-info-table -o ~/grub.iso grub_build
cdrecord dev=ATA:1,0,0 padsize=63s -pad -v -eject ~/grub.iso
```

The mkisofs command

mkisofs	The command
-R	Rock Ridge extensions
-b	El Torito boot, followed by boot image file
-no-emul-boot	Do not put the boot code in a file system
-boot-load-size	Number of 512 byte sectors of bootcode to load
-boot-info-table	Insert 56 byte info into stage2_eltorito
-o	Output file follows
grub_build	The directory to archive

Creating a grub CD without stage2_eltorito

- Log in as root and go to root's home directory
- Create the floppy image for el torito
  - dd if=/dev/zero of=zero.zero bs=512 count=2880
  - cat /boot/grub/stage1 /boot/grub/stage2 zero.zero > myfloppy.rough
  - dd if=myfloppy.rough of=myfloppy.img bs=512 count=2880
- Load the CD with all things grub
  - mkdir -p /tmp/mycd/boot/grub/menu
  - cp -Rp /boot/grub /tmp/mycd/
  - cp ~/myfloppy.img /tmp/mycd/
  - cd /tmp/mycd/boot/grub
  - cp /sbin/grub .
  - mv menu.lst menu
  - rm menu.*
  - delete any other unnecessary files
    - Typically anything but stage files and the grub executable
- Create the CD ISO
  - cd ~
  - mkisofs -pad -b myfloppy.img -R -o /tmp/mycd.iso /tmp/mycd
    - -b specifies the boot image
    - -R specifies Rock-Ridge extensions
    - -o specifies the output file
    - /temp/mycd is the directory to back up
    - Creates a bootable grub CD with all grub files on it
- Burn the CD
  - cdrecord dev=ATA:1,0,0 padsize=63s -pad -v -eject /tmp/mycd.iso

Installing grub from package
    Use package manager
Installing grub from source
    Download grub-0.97.tar.gz
        (later versions are grub 2)
    tar xzvf grub-0.97.tar.gz
    cd grub-0.97
    ./configure
    make
    make check
        : If your purpose is to get a complete stage2_eltorito equipped grub
        : distro, you needn't run make install. Instead, copy the appropriate
        : files to a directory in which you'll use mkisofs. If, however, you
        : want to install or upgrade your system's grep, do the make install.
    make install
Installing grub from a complete floppy
    Boot the floppy
    Boot from the grub prompt
    Log in as root
    mount /dev/fd0u1440 /mnt/floppy
    cp -Rp /mnt/floppy/boot/grub /boot
    cp -p /boot/grub/grub /sbin/
    /sbin/grub
        root (hd0,4) # Assuming /boot is on /dev/hda5
        setup (hd0)
        quit
    umount /dev/fd0u1440
    eject the floppy
    reboot and test

- Installing to a dedicated grub partition
  - Advantages
    - Easy way to support large number of distros
    - New installs don’t erase previous distros’ boot params
    - Easy to find by its small size
  - Procedure
    - Assume the partition is /dev/hda8
    - Create smallest possible /dev/hda8 larger than 1MB
    - mkfs.ext2 /dev/hda8
    - mkdir /mnt/hda8
    - su -c "mount /dev/hda8 /mnt/hda8"
    - mkdir -p /mnt/hda8/boot
    - cp -Rp /boot/grub /mnt/hda8/boot/
    - cp -p /sbin/grub /mnt/hda8/boot/grub/
    - Edit /mnt/hda8/boot/grub/menu.lst as appropriate
    - cd /mnt/hda8/boot/grub
    - ./grub
      - root (hd0,7)
      - setup (hd0)
      - quit
    - reboot