The Bootloader

How Grub works, booting other OSs

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Grub: Grand Unified Bootloader

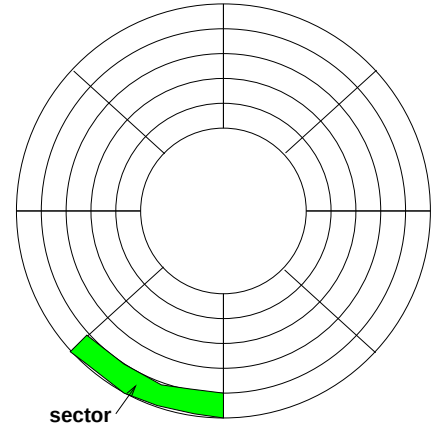
- A bootloader can be very simple, provide minimal functionality
- Can pay money for tools such as System Commander, or BootMagic (with Partition Magic)
- Or use LILO, or better still, Grub.
- Grub aims to boot anything on an Intel 86 architecture

Booting Windows on an Intel Computer

- BIOS loads *MBR* (Master Boot Record), first 512 bytes of "first" hard disk to RAM
- BIOS jumps to this code
- That code (by default) reads first sector of first active partition, the *boot sector*
- boot sector code then loads the operating system

Disk sectors, cylinders

- The rings are called *cylinders*:



Methods of Booting

- BIOS always loads MBR
- MBR can load a bootloader, such as grub's `stage2` or LILO
- Booting OS directly:
  - bootloader can load an operating system kernel directly
- *Chaining bootloaders*:
  - bootloader can load another bootloader which in turn loads an operating system

How grub works

- We install "`stage1`" of grub into MBR
- `stage1` reads `stage1_5` or `stage2` from a list of disk blocks
- `stage1` loads `stage1_5` from hard disk
- `stage1_5` can now read files on the hard disk, and loads `stage2`
- `stage2` of grub provides commands to support many features

Features of grub

- support directly loading many different operating system kernels
- can directly read many file system formats
- can load a configuration file from disk
- can decompress files automatically
- can read any device that the BIOS recognises
- is independent of drive geometry
- can detect all RAM
- supports Logical Block Address mode (LBA)
- supports network booting
- supports remote (serial) terminals

Installing grub into MBR from floppy

- Create a grub installation disk
  - see the lab sheet to see how
- Boot computer with this disk, type:

```
grub> find /boot/grub/stage2
grub> root (hdx,y)
grub> setup (hdx)
```

Installing grub into MBR from floppy — 2

- What happens when type

  `grub>` **`find /boot/grub/stage2`**

  - grub searches all partitions for that file
  - lists the partitions that contain `stage2` of grub
- What happens when type

  `grub>` **`root (hd`*`x`*`,`*`y`*`)`**

  - The "*x*" and "*y*" were found in previous step
  - grub mounts the partition, and determines file system type

Installing grub into MBR from floppy — 3

- What happens when type

  `grub>` **`setup (hd`*`x`*`)`**

  - grub copies small `stage1` to MBR of disk *x*
  - installs a list of sectors containing the `stage1_5` file
  - aim is so `stage1` can load `stage1_5` when booting

Booting using grub

- BIOS loads `stage1` from MBR
- `stage1` knows which sectors of hard disk contain `stage1_5`, so
  - loads `stage1_5` into RAM,
  - jumps to that code
- `stage1_5` can now read the file system containing `stage2`
- reads `stage2` from hard disk
- `stage2` can read the menu in `/boot/grub/grub.conf`
- `stage2` can boot (almost?) any operating system from any disk BIOS can read