Installing an operating system

Partitions

- what they are
- hard drive has them
  - up to 4 primary (traditional)
  - up to 128 (newer GPT “GUID partition table”)
- extended/logical (to break limit of 4)
- MBR – contains partition table (traditional)
Diskette Layout

Boot sector

Data area

Hard disk layout

MBR

Boot sector

Data area - partition 1

Boot sector

Data area - partition 2

Boot sector

Data area - partition 3

Boot sector

Data area - partition 4
**MBR - Master Boot Record**

- Code (bootloader)
- Partition Table

- 446 bytes
- 64 bytes

**Partition Table Record**

- Active
- Start H/SC
- Type
- End H/SC
- Partition start (sector)
- Partition size* (sectors)

- 80H
- 00H

* the encoding used here can represent a 2TB partition size, maximum. Modern disks can be bigger. This requires a replacement, known as GUID partition tables.

http://www.win.tue.nl/~aeb/partitions/partition_tables.html
http://www.edm2.com/0603/drive.html

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Example – a disk’s 3rd partition

<table>
<thead>
<tr>
<th>Active</th>
<th>Start H/SC</th>
<th>Type</th>
<th>End H/SC</th>
<th>Partition start (sector)</th>
<th>Partition size (sectors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80H</td>
<td>00</td>
<td>81</td>
<td>95</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3f</td>
<td>ff</td>
<td>e4</td>
<td>c0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>aa</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>00</td>
<td>ac</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14</td>
<td>00</td>
</tr>
</tbody>
</table>

output of “fdisk -l” command:

Disk /dev/hda: 64 heads, 63 sectors, 1023 cylinders
Units = sectors of 1 * 512 bytes

<table>
<thead>
<tr>
<th>Device</th>
<th>Boot</th>
<th>Start</th>
<th>End</th>
<th>Blocks</th>
<th>Id</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/hda1</td>
<td></td>
<td>63</td>
<td>1641023</td>
<td>820480+</td>
<td>c</td>
<td>Win95 FAT32 (LBA)</td>
</tr>
<tr>
<td>/dev/hda2</td>
<td></td>
<td>1641024</td>
<td>2665151</td>
<td>512064</td>
<td>7</td>
<td>HPFS/NTFS</td>
</tr>
<tr>
<td>/dev/hda3</td>
<td>*</td>
<td>2665152</td>
<td>4019903</td>
<td>677376</td>
<td>83</td>
<td>Linux</td>
</tr>
<tr>
<td>/dev/hda4</td>
<td></td>
<td>4019904</td>
<td>4124735</td>
<td>52416</td>
<td>82</td>
<td>Linux swap</td>
</tr>
</tbody>
</table>

PC Booting sequence (traditional)

- BIOS’s code
- MBR’s code
- then what?
  - MBR’s code passes control downstream
  - “where to” depends entirely on MBR’s code
- if “standard/dos” MBR
  - To boot sector of partition marked active in table
- if lilo or GRUB
  - to known code at a predetermined disk location
PC Booting sequence

- bios firmware code
- boot loader
- kernel

Multiple drives

- can have many hard drives
- each follows this partition scheme
Referring to partitions

- MS uses letters like C:
- Linux does not

Linux partition nomenclature

- “device names” are used
- sda vs. sdb
  - differentiate drives
- sda vs. sda1 sda2 etc
  - differentiate drives from their partitions
- sda1-4 vs. sda5-8
  - differentiate primary/extended partitions from logical ones
Partitioning for Installation

- Linux requires at least 1 partition
- a second partition for “swap” is beneficial
- may utilize several partitions
  - each with its own “filesystem”
  - each “filesystem” holds part of the tree
  - glued together by “mount” at boot/run time

Installation requirements

- an available existing partition, or
- empty space from which to create one
  - large enough
  - allowable within partition rules (4 max)
Partition(s) receive file system

- file system has *physical* type
- file system has *logical* directory hierarchy
- both are called “file system”

A physical filesystem’s layout

- purpose: associate names with bodies of data (aka “content”)
- method: reserve part of the disk for a directory
- analogous to book’s table of contents consuming first few pages
Physical file system types

- FAT    DOS
- FAT32  Windows 98
- HPFS   OS/2
- NTFS   Windows NT
- ext2/ext3 Linux
- iso9660 CD-ROM

An example: FAT

Advanced MSDOS, Ray Duncan, Microsoft Press, 1986, p. 149
Reading file system types

- Linux can read its own file system type
  - ext2
- Linux can read other types of file systems
  - FAT
  - FAT32
  - iso9660
  - NTFS

A logical file system’s organization: a hierarchy

- a tree structure of directories
- the directory tree is mostly standardized

- but varies slightly among distributions
Mounting file systems

- grafting “subdirectories” onto file tree
- integrates different devices’ subtrees into a single hierarchy
- grafting location in tree called “mount point”
- examples
  - transient mount of diskette drive to access floppy
  - mount a new hard drive to incorporate its capacity
- `/etc/fstab` for mount persistency

Replacing BIOS: extensible firmware interface
1TB GPT drive

Where to Get More Information

“Make the most of large drives with GPT and Linux, Preparing for future disk storage with the GUID Partition Table”

GPT fdisk tutorials
http://www.rodsbooks.com/gdisk/index.html
http://www.sysresccd.org/Sysresccd-Partitioning-EN-The-new-GPT-disk-layout

GUID partition table
http://en.wikipedia.org/wiki/GUID_Partytion_Table
Where to Get More Information
-- on your computer

- Man pages
- "documentation" subdirectories
  ( e.g. /usr/share/doc/ )

Where to Get More Information
-- on the internet

- The Linux Documentation Project (www.tldp.org)
  - HOWTOs
    - Linux Partition HOWTO
    - Filesystems HOWTO
  - Guides
    - The Linux System Administrators' Guide
    - Linux Filesystem Hierarchy
- Distributions’ documentation
  - http://fedoraproject.org/
Where to Get More Information

-- other sources

- **Linux Journal**  http://www.linuxjournal.com/
- **Selected books**
  - *Fedora 10 and Red Hat Enterprise Linux Bible*, Christopher Negus, Wiley 2009