

# CST8207 – Linux O/S I

## Partitions

# But first...Some tricks and traps

- ▶ Lab due dates:
- ▶ Labs are due as specified usually on Page 1 of the Lab document
- ▶ Lab due dates are expressed as:  
“10 min before the end of the lab period during a certain week”

There is a grace period (late labs will be accepted up to 1 minute before the next lab period after it's due) **But it's late, so use the grace period for emergencies only!**

# But first...Some tricks and traps

- ▶ **Command Line Process** (for now we think of it this way):
  - ▶ 1. Prompt user for command
  - ▶ 2. Read command from user, interpret it
    - variables, shell filename globbing, quoting, etc (more later)
  - ▶ 3. If command is not builtin to shell, look for the program file to use (PATH variable)
  - ▶ 4. Run the (shell-interpreted) command, such that...(see 5 below)
  - ▶ 5. Output of command is printed to terminal
  - ▶ 6. Repeat, starting at 1.

# Tricks and traps

- ▶ The audible “bell” character  $\wedge G$  in a filename
- ▶ Notice how the shell treats it like any other character, but the “ls” command replaces it with a “?” so you can see it and it doesn’t “control” anything ( $\wedge G$  is called control-G because it’s a non-printing control character)
- ▶ What if we set our PATH to nothing? (now the shell doesn’t look for commands)
- ▶ What can we do if we have NO commands? (we still have the shell builtins, like “echo”. And even with no path, the commands are still there so we can use /bin/ls for example.
- ▶ What if we put a  $\wedge G$  in our prompt (PS1)?

# Pathnames in Linux (roughly)

- ▶ Think of a file in linux like a McDonalds
- ▶ Relative paths: let's go to the McDonalds down the street (which McDonalds are they going to? What is the current working street (current working directory) of the person speaking?)
- ▶ Absolute Paths: let's go to the McDonalds at 384 Baseline Road, in Ottawa, in Ontario, in Canada, in North America, on Earth, in the Milky Way, in our Universe, /

# Common traps in labs so far

- ▶ `rmdir parent/child parent`
- ▶ There are three “things” in that command
- ▶ 1. the command `rmdir`
- ▶ 2. a relative pathname of a directory
- ▶ 3. another relative pathname of a directory
- ▶ This command removes one directory, namely “parent/child”, and then removes another directory, “parent”
- ▶ `rmdir parent/child` removes “child”, from “parent”, but does not remove “parent”

# Non-printing characters like space

- ▶ Watch out for the command line token separator, which is one (or more) spaces
- ▶ In other words, when in doubt about whether there is a space character, think about whether something you're typing in is two words, or one word
- ▶ Example: `cd /` we know this has to be two words with a space in it: it cannot be `"cd/"`
- ▶ Beware the `".."` name of the parent directory, because `". ."` with a space between dots is two words (the current directory twice?)

# Topics

- ▶ Disk Partition Table
- ▶ Identifying Partitions
- ▶ Linux Partitions
- ▶ Linux Filesystems (again, but different)
- ▶ fdisk and Disk Druid

# Associated Readings

- ▶ Chapter 3: pages 71 – 82
- ▶ You've already read this
- ▶ it's about the partitioning that was done as you installed Fedora

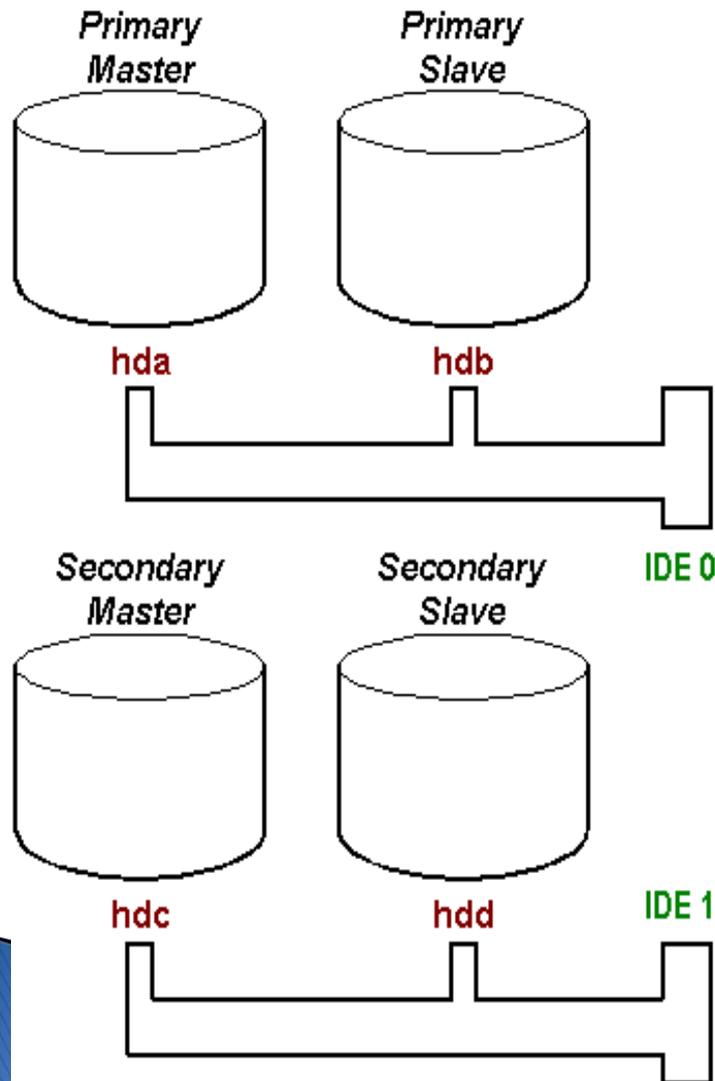
# Overview of partitioning

- ▶ A partition is a section of disk that holds a filesystem
- ▶ The **Master Boot Sector** contains the **Disk Partition Table**, which can hold up to four entries due to the way in which the master boot record is structured
  - If you use a tool like partition magic, you can create more than four partitions
- ▶ Each Disk Partition Table entry describes a partition by specifying its:
  - first cylinder
  - last cylinder
  - whether it is bootable
  - a filesystem identifier.

# Partitioning

- ▶ We deal primarily with the MSDOS Partition Table type
- ▶ GPT partition tables getting common: GUID Partition Table
- ▶ Globally Unique Identifier (but back to MSDOS Tables...)
  
- ▶ A partition in the DPT can be either a **Primary partition** (more than one possible) or an **Extended Partition** (only one possible per disk)
  
- ▶ Up to four Primary Partitions are possible in a single table
  
- ▶ One of the four partition entries can be designated as an Extended partition , which consumes the rest of the drive
  - This allows for creating Logical drives, or sub-partitions, within it

# Identifying Partitions – Drives



## Naming IDE disk drives

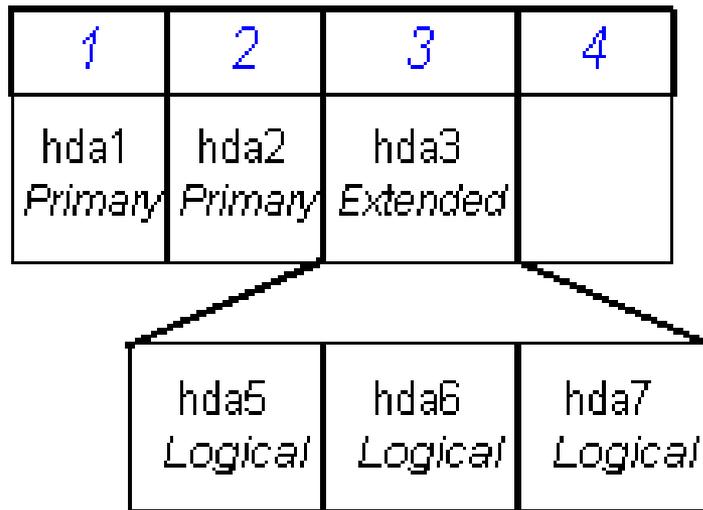
- ▶ Primary master --- hda
- ▶ Primary slave ----- hdb
- ▶ Secondary master - hdc
- ▶ Secondary slave -- hdd

# Identifying Partitions – Drives

## **Naming SATA disk drives**

- ▶ sda
- ▶ sdb
- ▶ sdc
- ▶ sdd

# Identifying Partitions



## Naming partitions

- **hdx1 – hdx4**
  - Partitions recorded in the partition table
- **hdx5 – hdx63**
  - Logical drives

Note: You can have up to 4 primary partitions created in your system, while there is only one extended partition.

# Linux Partitions

- On the previous slide, Partition 4 can't be created because there's no space for it. In this case, Partition 3 is extended, and therefore takes up all remaining space.
  - There is 1 or more primary partition, 1 extended and unlimited logical partitions within extended
  - Fine to have multiple primary partitions without an extended, but a little harder to manage
  - Each partitions is represented by Linux as a “*device*”, that can contain a filesystem, that can be mounted to a directory within the main directory tree
- ▶ ***Be warned - partitioning is not to be taken lightly***
- playing with **fdisk** or any partitioning tool without prior planning and backup of your data *could potentially destroy all data on the drive.*

# Linux Partitions

- ▶ Linux *requires* 2 partitions to exist to work properly

*/ (root)* partition

*<swap>* partition

# / (root) partition

- ▶ primary requirement for kernel & O/S to have any capabilities outside itself
- ▶ only one root filesystem under which everything exists
- ▶ size depends installed packages and associated files

# / (root) partition

- ▶ typically will span many mounted filesystems in hierarchy
- ▶ how many separate filesystems are mounted on mount points in the root filesystem varies
- ▶ contains the core of the Linux filesystem content
- ▶ loaded in read-only mode for verification then remounted in read-write mode once verified (*to be discussed in future lectures*)

# <swap> Partition

- ▶ recommended size depends on the amount of physical RAM on the system
- ▶ Small amount of RAM, go with 2 X RAM
- ▶ Large amount of RAM, go with 1 X RAM (or even none?)
- ▶ *must be Linux swap* partition type
- ▶ used for virtual memory implementation
- ▶ not visible as a mounted partition, but used directly by the kernel
- ▶ can be up to eight swap partitions active at any time

# Other Linux Partitions: /home

- ▶ to allow for maintenance of user files and growth of storage space over time
- ▶ size varies, but should allow for enough space per individual user to store their personal or shared files
- ▶ *usually defined as a variable size partition during automated install ; can span multiple disks*
- ▶ minimum recommended size of 512 MB (these recommendations change over time)
- ▶ typically managed using disk quotas (ie user cannot use more than his quota)

# Other Linux Partitions

## ▶ **/var**

- contains large log files and data files created and maintained by the system and applications
- recommended size of 256 megs (again, this changes...)

## ▶ **/usr**

- typically contains user installed applications and source code
- *usually defined as a variable size partition during automated install; can span multiple disks*
- minimal recommended size of 512 megs (again, this changes..)

# Linux Filesystems

- ▶ Prior to kernel **2.4.x**, Linux was using the **ext2** filesystem type as its native filesystem
  - very efficient and effectively maintained over time
  - somewhat limited in security and management tools by some standards
- ▶ From kernel **2.4.x** on, Linux is now adopting the newly implemented **ext3** journaling filesystem
  - even more efficient than ext2
  - higher security
  - more tracking of changes of the filesystem
  - easier recovery of damaged filesystem
- Now there's ext4
- ▶ A more detailed comparison of these filesystem types will be discussed later on.

# Linux can access/read the following filesystems

- ▶ *ext* – predecessor of the ext2 Linux filesystem
- ▶ *ext2* – predecessor of ext 3 Linux Filesystem Standard
- ▶ *ext3* - Linux Journalling Filesystem
- ▶ *ext4* – Improves on ext3
- ▶ *nfs* - Network Filesystem filesystem over networks
- ▶ *msdos* - MS-DOS/Windows FAT/FAT16 filesystem
- ▶ *vfat* - MS FAT32 (*Win9x*) filesystem
- ▶ *ntfs* - Windows NT's/2k/XP NTFS filesystem
- ▶ And many others... **XFS, BTRFS, ZFS, Reiser ...**

- ▶ *hpfs* - IBM OS/2 filesystem
- ▶ *iso9660* - standard filesystem for CD-ROMs
- ▶ *sysv* - AT&T's System V Unix filesystem
- ▶ *cdfs* – Mac OS X, Linux, FreeBSD
- ▶ HFS+ - OS X
- ▶ *qnx4* - QNX4 partitions
- ▶ *ncpfs* - Novell server filesystem
- ▶ *exFAT*- Windows CE 6.0
- ▶ ...

And many more being added or considered

# Options for Partitioning

- ▶ DOS **fdisk** program
  - Very limited Linux support
- ▶ Linux **fdisk** program
  - similar to DOS fdisk, but more features available
  - can only be used under Linux/UNIX
- **parted** can handle GPT partition tables
- ▶ **Disk Druid** program
  - Part of the Fedora installation system
  - Can not be run on its own
- ▶ **GParted** (*Fedora, Ubuntu*)
  - Gnome Partitioning Editor: GUI based partitioning
  - only runs from within Linux/UNIX

**/dev/sda - GParted**

GParted Edit View Device Partition Help

New Delete Resize/Move Copy Paste Undo Apply

/dev/sda (15.00 GiB)

/dev/sda1  
12.69 GiB

/dev/sda2  
1.95 GiB

Partition	Filesystem	Mountpoint	Label	Size	Used	Unused	Flags
/dev/sda1	ext3	/	/	12.69 GiB	6.49 GiB	6.20 GiB	boot
/dev/sda2	linux-swap			1.95 GiB	---	---	
unallocated	unallocated			360.83 MiB	---	---	

0 operations pending

# Options for Partitioning

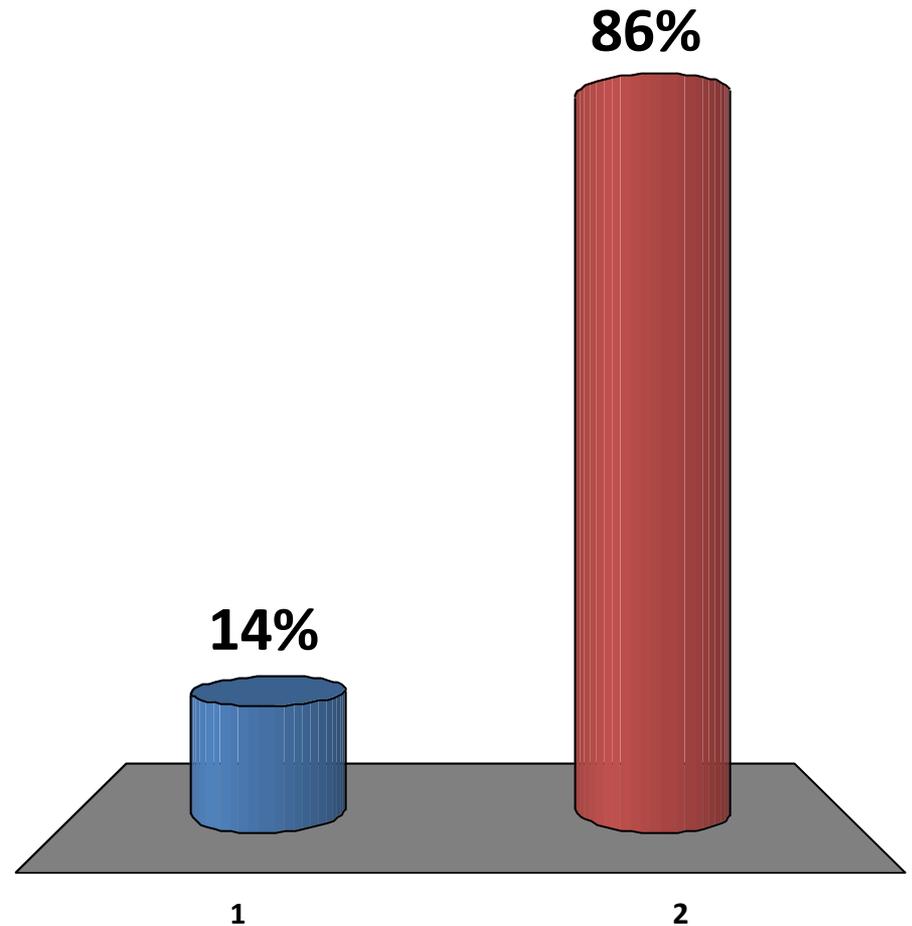
- ▶ Third-party tools (e.g. *Partition Magic*, etc)
  - may or may not be included with Linux
  - must make sure software properly understands partition types being affected
- ▶ **Note: Do not try to partition the drives already installed on lab machines at Algonquin... They have already been partitioned!**

# Linux **fdisk** command

- ▶ **fdisk** *[options]* *device*
  - command-line partition table manipulator for Linux
  - allows for viewing or modifying existing partition table and/or creating new partition(s) for a specified device
  - can set Partition Type for most of the common filesystems in use today
  - tries to obtain the disk geometry automatically to allow for more direct access to hard disk partition management

# Can you have more than one extended partion?

1. Yes
2. No



# What is the maximum number of primary partitions allowed?

1. one
2. two
3. three
4. four
5. more than four

