# Linux File System

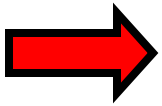
By : Amir Hossein Payberah

payberah@yahoo.com

Tehran Polytechnic University

دانشگاه صنعتی امیرکبیر
(پلی تکنیک تهران)

# Contents



- What is File System?
- Important Directories in Linux
- Mounting File System
- Partitions
- Creating File System
- Some useful commands and tools

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# What is File System?

- It is responsible for storing information on disk and retrieving and updating this information.
- Example :
  - FAT16, FAT32, NTFS
  - ext2, ext3
  - ...
- In Linux everything is file.

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# Type of File System

- Network File System
  - NFS
  - SMB
- Disk File System
  - ext2
  - ext3
  - FAT32
  - NTFS

# Network File System

- Network File System are physically somewhere else, but appear as if they are mounted on one computer.
- NFS
  - It was developed by Sun.
- SMB
  - It was developed by Microsoft.

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# Disk File System

- Disk File System are what you will find on a physical device, such as hard drive in a computer.

# ext2 File System

- It has been the standard File System for Linux.
- The original Extended File System was named ext.
- The ext2 File System can accommodate:
  - Files as large as 2GB
  - Directories as large as 2TB
  - Max. file name length of 255 characters.

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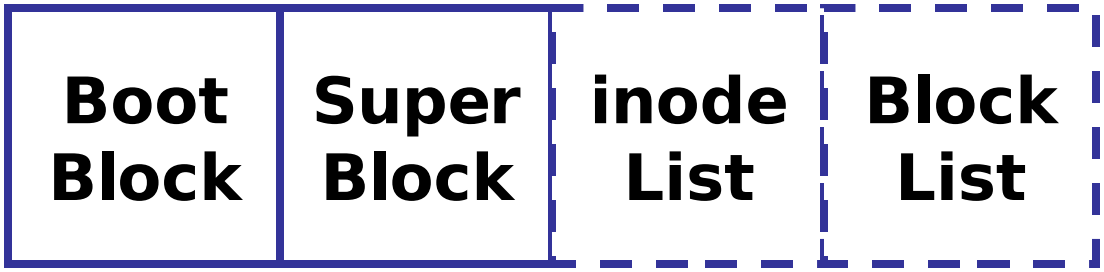
# ext2 Structure

- A file in the ext2 File System begins with the inode.
- inode
  - Each file has an inode structure that is identified by an i-number.
  - The inode contains the information required to access the file.
  - It doesn’t contain file name.

# Physical Structure on the Disk




- Boot Block : information needs to boot the system
- Super Block : File System Specifications
  - Size
  - Max. number of files
  - Free blocks
  - Free inodes
- inode List
- Block List : The files data

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# Symbolic Link

- Because of the structure of the ex2 File System, several names can be associated with a single file.
- In effect, you create another inode that reference already existing data.

# ext3 File System

- It is as same as ext2.
- It is a journaling File System for Linux.
- In a journaling system, metadata is written to a journal on the disk before it is actually used to modify the file.

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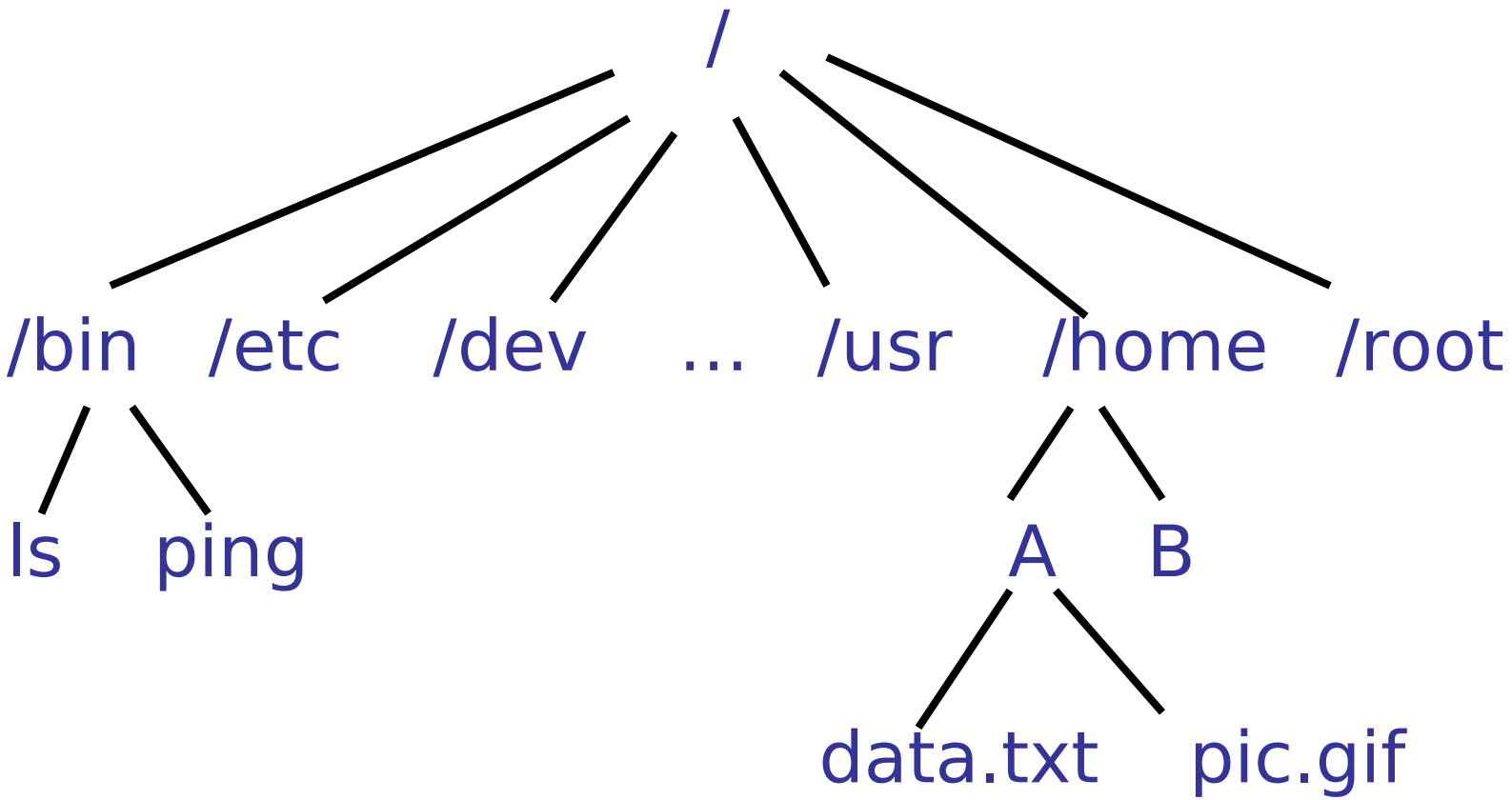
# File System Structure

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# /bin

- Hold the most commonly used essential user programs
  - login
  - Shells (bash, ksh, csh)
  - File manipulation utilities (cp, mv, rm, ln, tar)
  - Editors (ed, vi)
  - File system utilities (dd, df, mount, umount, sync)
  - System utilities (uname, hostname, arch)
  - GNU utilities like gzip and gunzip

# /sbin

- Hold essential maintenance or system programs such as the following:
  - fsck
  - Fdisk
  - Mkfs
  - Shutdown
  - Lilo
  - Init
  - ...
- The main difference between the programs stored in /bin and /sbin is that the programs in /sbin are executable only by root.

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# /etc

- Store the systemwide configuration files required by many programs.
  - passwd
  - shadow
  - fstab
  - hosts
  - lilo.conf
  - ...

# /home and /root

- The /home directory is where all the home directories for all the users on a system are stored.
- The /root directory is where all the home directories for root user on a system are stored.

# /dev

- The special files representing hardware are kept in it.
  - /dev/hda1
  - /dev/ttyS0
  - /dev/mouse
  - /dev/fd0
  - /dev/fifo1
  - /dev/loop2
  - …

# /tmp and /var

- The /tmp and /var directories are used to hold temporary files or files with constantly varying content.
- The /tmp directory is usually a dumping ground for files that only need to be used briefly and can afford to be deleted at any time.
- The /var directory is a bit more structured than /tmp and usually looks something like the following:
  - /var/log
  - /var/spool
  - /var/named
  - …

# /usr

- Most programs and files directly relating to users of the system are stored.
- It is in some ways a mini version of the / directory.
  - /usr/bin
  - /usr/sbin
  - /usr/spool
  - ...

# Other directories

- /mnt
  - removable media such as CD-ROM, floppy and … are mounted.
  - /mnt/floppy
  - /mnt/cdrom
- /boot
  - Image to boot system
- /lost+found
  - Used by fsck

# /proc

- It is a virtual File System
- A special File System provided by the kernel as a way of providing information about the system to user programs.
- The main tasks of proc File System is to provide information about the kernel and processes.

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# Mounting File System

- The Linux File System makes it appear as if all the File System are local and mounted somewhere on the root File System.
- File System are mounted with the mount command.
  - mount –t type source mount_point
- To unmount a File System, the umount command is used.
  - umount /dev/<device name> or mount_point

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# Mounting Automatically with fstab

- This file lists all the partitions that need to be mounted at boot time and the directory where they need to be mounted.
- Along with that information, you can pass parameters to the mount command.
- /etc/fstab
  - Which devices to be mounted
  - What kinds of File Systems they contain
  - At what point in the File System the mount takes place
  - ...

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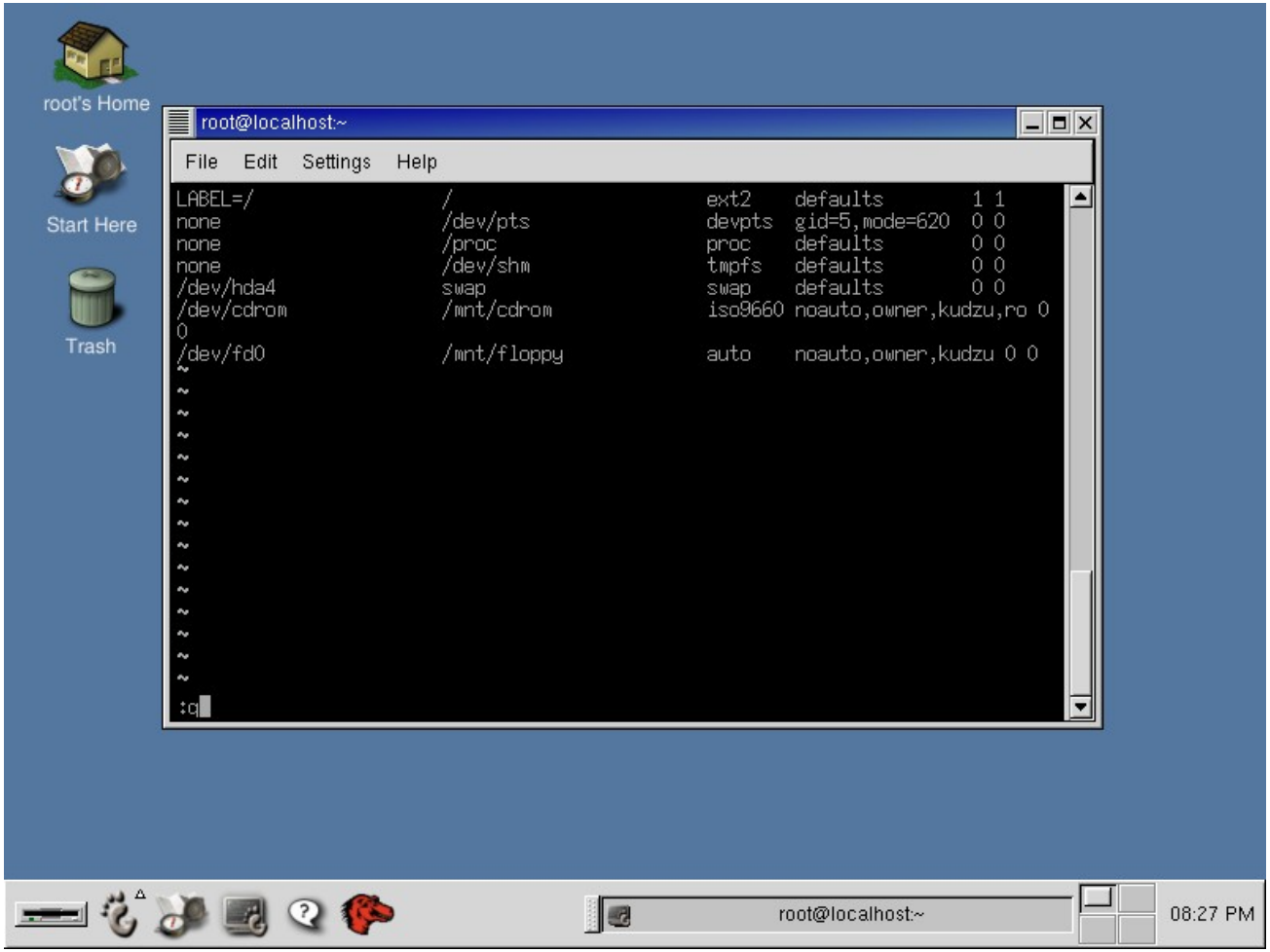
# fstab Example

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# fstab Structure

- Each line has six fields:
  - **1’st field**: indicates the block device or remote File System that will be mounted.
  - **2’nd field**: identifies the mount point the local system where the File System will be mounted.
  - **3’rd field**: File System type
  - **4’th field**: list of mount options
  - **5’th field**: it is used by dump (a backup program) to determine whether the File System should be dumped (1:yes, 0:no).
  - **6’th field**: it is used by fsck (0:never run, 1:run on the drive at predetermined, 2:it is recommended for non root File System so that fsck isn’t run on them as frequently).

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# Partition Table

- MBR (Master Boot Record)
  - The first sector
  - 512 bytes (**446 bytes**:boot loader such as LILO or GRUB, **64 bytes**:partition table, **2 bytes**:special code).
- The partition table has enough room for four partitions.
  - One of the four can be used as an extended partition.

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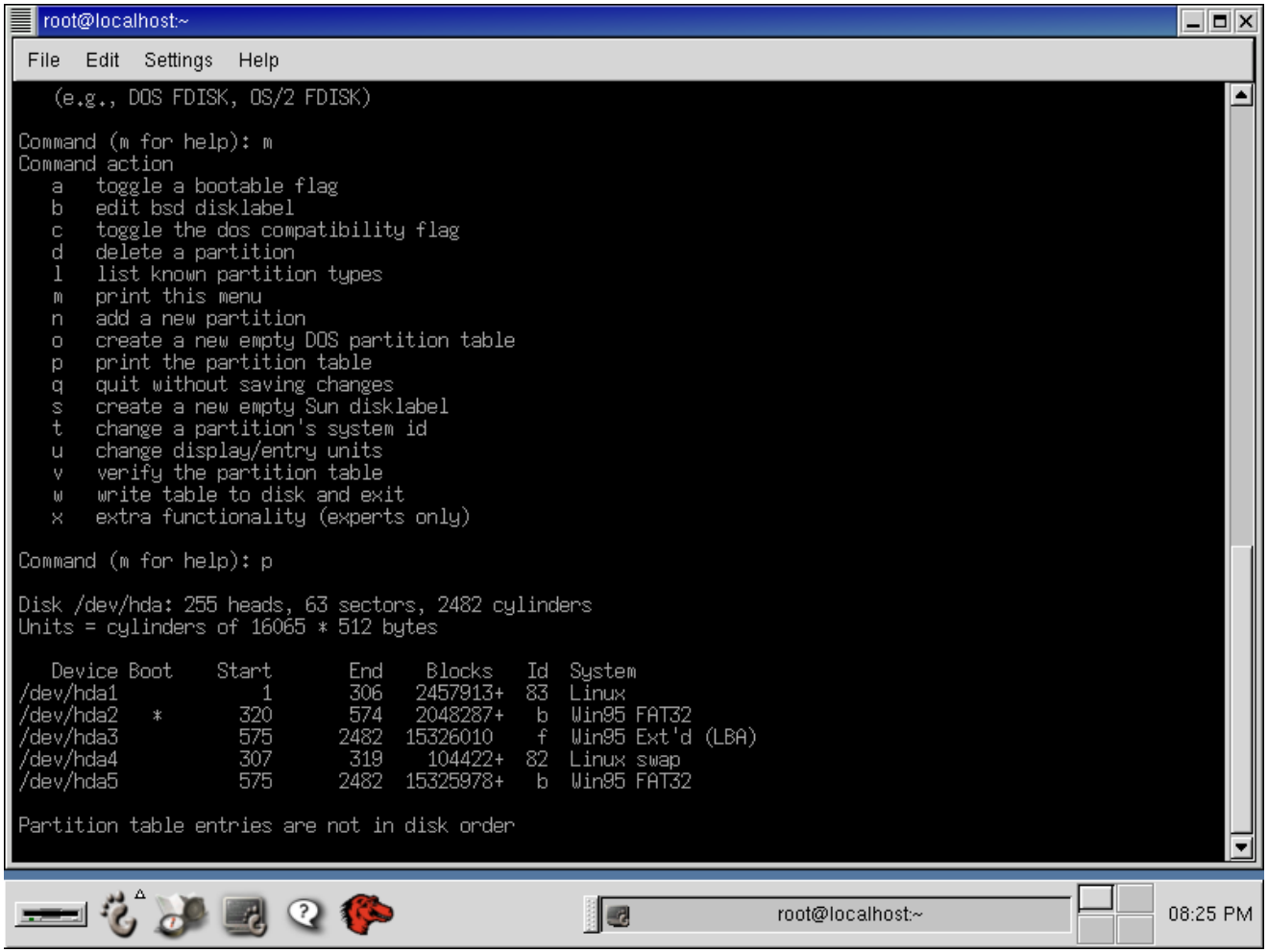
# Partitions

- Primary-Master
  - /dev/hda
- Primary-Slave
  - /dev/hdb
- Secondary-Master
  - /dev/hdc
- Secondary-Slave
  - /dev/hdd
- Swap Partition
  - Used to implement virtual memory

# fdisk

- The Linux fdisk counterpart in DOS edits the disk structure.
- You must be the superuser (root) to run fdisk.
  - fdisk /dev/had
- cfisk
  - It is the same as fdisk, but it gives a graphical interface at the console.

# fdisk Command

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# Creating File System

- Once a disk has been partitioned for a specific File System, it is necessary to create a File System on it.
- The first process in the DOS world is known as formatting.
- In the UNIX world is known as creating a File System.

# Create File System Commands

- mkfs or mke2fs
  - Make a new ext2 File System.
- mk3fs
  - Make a new ext3 File System.
- mkdosfs
  - Make DOS File System without owning any Microsoft software.

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# FS Commands and Tools

- pwd
  - Where am I?
- cd
  - Changes working directory.
- ls
  - Shows the contents of current directory
- cat
  - Takes all input and outputs it to a file or other source
- mkdir
  - Creates a new directory
- rmdir
  - Removes empty directore

# FS Commands and Tools (cont.)

- mv
  - Moves files
- cp
  - Copies files
- rm
  - Removes directory
- gzip and gunzip
  - To compress and uncompress a file
- tar
  - To compress and uncompress a file
- fsck and e2fsck
  - Checks and repairs a Linux File System (same as scandisk)

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# FS Commands and Tools (cont.)

- e2label
  - Displays or change the label of a device
- dd
  - Converts and copies a file
- df
  - Reports File System disk space usage
- du
  - Estimates file space usage
- ln
  - Makes links between files
- file
  - Determines file type
- tune2fs
  - Adds the journal to an existing ext2 File System

# Converting an ext2 File System to ext3

- First:
  - Use the tune2fs utility to add the journal to an existing ext2 File System
  - tune2fs –j /dev/hda2
- Second
  - Edit the appropriate line in /etc/fstab and change the value from ext2 to ext3.

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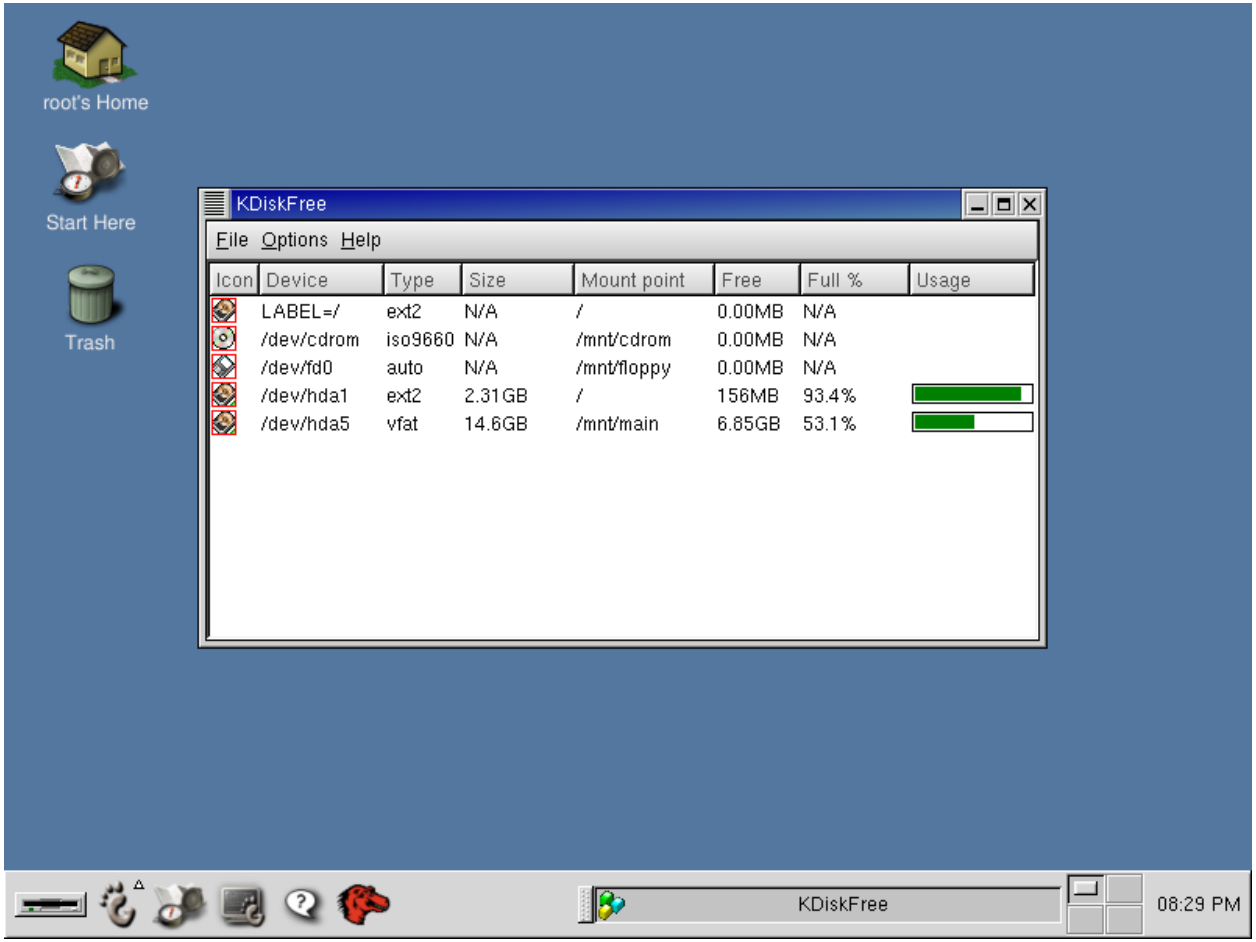
# FS Commands and Tools (cont.)

- KDiskFree

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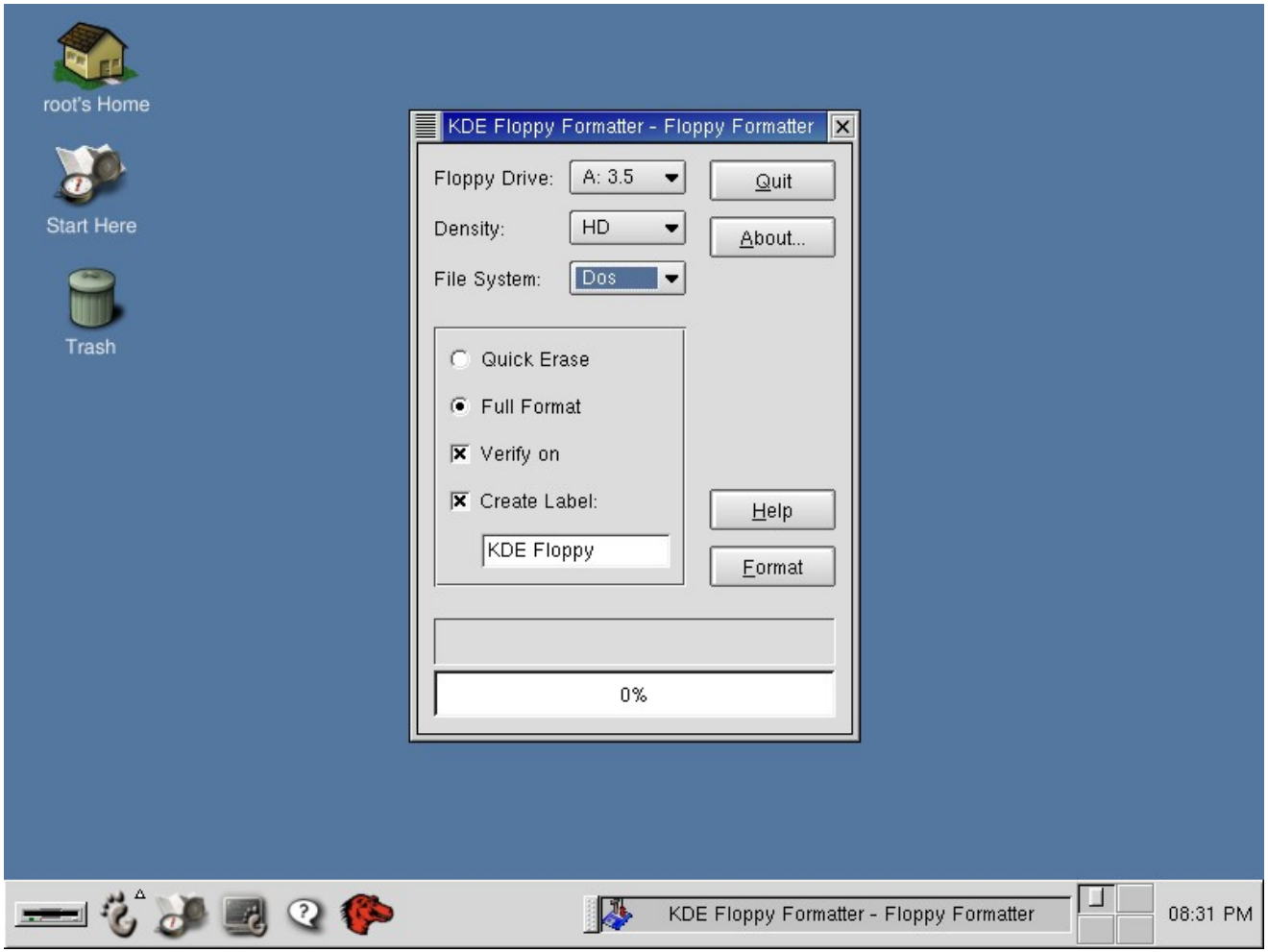
# FS Commands and Tools (cont.)

- Format a floppy

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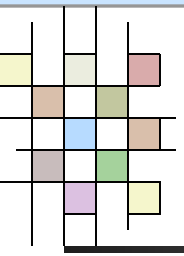

# Question?

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