The Linux File system in-depth

Partitions and File system

- Disk drive divided into *partitions*

- Partitions are formatted with *file system,* allowing users to store data

    - Default file system ext3, the third Extended Linux file system

    - Other common file systems:

        - ext2 and msdos (typically used for floppies)

        - iso96660 (typically used for CDs)

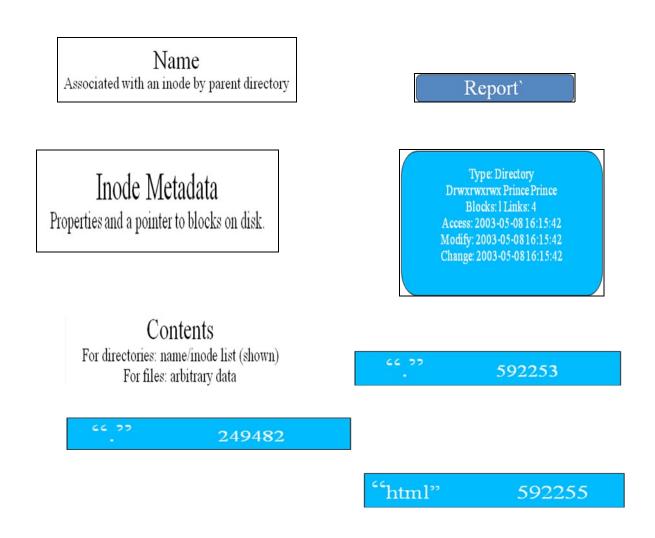   - GFS and GFS2 (typically for SANs)

inodes

- An inode table contains a list of all files in an ext2 or ext3 filesytem

- An inode (inbox node) is an entry in the table, containing information about a file (the metadata), including:

    - File type, permissions, UID, GID

    - The link count (count or path names pointing to this file)

    - The file's size and various time stamps

    - Pointers to the file's data blocks on disk

    - Other data about the file

Directories

- The computer's reference for a file is the inode number

- The human way to reference a file is by file name

- A directories is a mapping between the human name for the file and the computer's inode number

- **Inodes and Directories**

Name
Associated with an inode by parent directory

Report`

Inode Metadata
Properties and a pointer to blocks on disk.

Type: Directory
Drwxrwxrwx Prince Prince
Blocks: 1 Links: 4
Access: 2003-05-08 16:15:42
Modify: 2003-05-08 16:15:42
Change: 2003-05-08 16:15:42

Contents
For directories: name/inode list (shown)
For files: arbitrary data

".."   592253

"."   249482

"html"   592255

"text"   592254

cp and inodes

- The cp command:

    1. Allocates a free inode number, placing entry in the inode table

    2. Creates a dentry in the directory, associating a name with the inode number

    3. Copies data into the new file

mv and inodes

- If the destination of the **mv** command is on the same file system as the source, the **mv** command:

    1. Creates a new directories entry with the new file name

    2. Deletes the old directories entry with the old file name

- Has no impact on the inode table (except for a time stamps) or the location of data on the disk: nodata is moved!

- If the destination is deferent file system, **mv** acts as a copy and remove

rm and inodes

- The **rm** command:

    1. Decrement the Link count, thus freeing the inode number to be reused

    2. Places data blocks on the free list

    3. Removes the directories entry

- Data is not actually removed, but will be overwritten when the data blocks are used by another file

Hard Links

- A hard link adds an additional pathname to reference a single file

- One physical file on the file system

- Each directory references the same inode number

- Increments the link count

  - The rm command decrement the link count

  - file exists as long as at least one link remains

  - When the link count is zero, the file is removed

- Cannot span drives or partitions

- Syntax:

In filename [linkname]

Symbolic (or soft links)

- A symbolic link points to another file

  - ls –l displays the link name and the referenced file

lrwxrwxrwx l joe ll sep 25 18:02 pf -> /etc/passwd

  - File type: l for symbolic link

  - The content of a symbolic link is the name of the file that it references

- Syntax:

  - ***ln -s filename linkname***

Checking Free Space

- **df** – report disk space usage

  - Reports total kilobytes used, kilobytes free per line system

  - **-h** and **–H** display sizes in easier to read units

- **Du** – Reports disk space usage

  - Reports kilobytes used per directory

  - Includes subtotals for each subdirectory

    - -s option only reports single directory summary

  - Also takes **–h** and **–H** options

- Application à System tools à Disk usage analyzer or **baobab** reports disk space usage graphically

Removable Media

- Mounting means making a foreign file system look like part of the main tree.

- Before accessing, media must be mounted

- Before removing, media must be uncounted

- By default, non-root users may only mount certain devices (cd, dvd, floppy, usb, etc)

- Mount points are usually under /media

Mounting CDs and DVDs

- Automatically mounted in Gnome /KDE

- Otherwise, must be manually mounted

    - CD/DVD Reader

        - Mount /media/cdrom

    - CD/DVD Writer

        - Mount / media/ cdrecorder

- Eject command unmounts and ejects the disk

Mounting USB media

- Detected by the kernel as SCSI devices

    - /dev/sdax or /dev /sdbx or similar

- Automatically mounted in Gnome/KDE

    - Icon created in Computer window

- Mounted under */media /device ID*

    - ***Device ID is built into device by vendor***

Mounting Floppy Disks

- Must be manually mounted and unmounted

    - mount /media /floppy

    - umount /media/ floppy

- Dos floppies can be accessed with **mtools**

    - Mounts and unmounts device transparently

    - Uses DOS naming conventions

        - **mdir a:**

        - **mcopy /home/file.txt a:**

Archiving Files and Compressing Archives

- Archiving places many files into one target file

    - Easier to back up, store, and tranfer

    - **tar-** standard Linux archiving command

- Archives are commonly compressed

    - Algorithm applied that compresses file

    - Uncompressing restores the original file

    - **tar** natively support compression using **gzip** and **gunzip**, or **bzip2** and **bunzip2**

Creating, Listing, and Extracting File Archives

- Action arguments (one is required):

    - -c create an archive

    - -t list an archive

    - -x extract files from an archive

- Typically required:

    - -f **archivename** name of file archive

- Optional arguments:

    - **-z** use **gzip** compression

    - **-l** use **bzip2** compression

    - **-v** be verose

Creating File Archives: Other tools

- **zip** and **unzip**

    - Supports **pkzip**-compatible archives

    - Example:

zip etc. zip /etc

unzip etc.zip

- File-roller

    - Graphical, multi-format archiving tool