

Administration of Operating Systems

DO2003

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Files, Directories, and Filesystem



What you know already

- Lecture 2 presented the Linux Filesystem
 - How the filesystem is organized
 - Directories of files in a hierarchical structure
 - All files and directories have a common root
 - Directory files and ordinary files
 - Directories can contain other directories as well as regular files, which are the "leaves" of the tree
 - Rules for naming files and directories
 - How to create and delete directories, navigate through the filesystem and access files
 - Access permissions and Access Control Lists

Important system files and directories

- “On a Linux system, everything is a file”
 - It is important for a system administrator to become familiar with important Linux files and directories
 - Some files are configuration files while others are programs or devices abstracted by Linux through files
 - Some of these files are located in specific places in the Filesystem Hierarchy Standard

Files and directories used to administer the system

- **~/.bash_profile**
 - Login shell script executed to initialize the user's shell before the initial command prompt
 - If not present, tries `.bash_login`, otherwise `.profile`
- **~/.bashrc**
 - Nonlogin shell initialization script executed every time a new shell is created from the shell
 - Setup individual user's variables and aliases

Files and directories used to administer the system

- **/dev – Device Files**

- Contains all device files which refer to various hardware devices on the system, including hard drives, printers, ...
- /dev/fd0 and /dev/fd1 – Floppy disks
- /dev/hda and /dev/hdb – M/S disks on the primary IDE
- /dev/sda – non IDE drive, such as USB or SATA
- /dev/sr0 is the device file for the cdrom
- /dev/null
 - Device file that discards all data written to it and provides null values (no data) to any process that reads from it

Files and directories used to administer the system

- **/etc – Machine local system configuration files**
 - Contains system-global configuration files, which affect the system's behavior for all users
 - /etc/profile – File that allows the system administrator to establish system wide environment parameters
 - Individual users can override it in their ~/.bash_profile
 - /etc/bash.bashrc – Initialization script
 - /etc/group – File that holds information about group definitions
 - /etc/fstab – File containing a list of all mountable devices

Files and directories used to administer the system

- **/etc – Machine local system configuration files**
 - /etc/hostname – File storing the hostname of the system
 - /etc/hosts – File containing host names and their corresponding IP addresses used for name resolution whenever a DNS server is unavailable
 - /etc/motd - "message of the day" file printed upon login
 - /etc/passwd – File containing info about system users
 - /etc/shadow – File containing the user passwords
 - /etc/hosts.allow and /etc/hosts.deny – Files that store a list of hosts allowed and forbidden to access services on the host compute

Files and directories used to administer the system

- **/ect – Machine local system configuration files**
 - /etc/init.d – Directory containing a number of start/stop scripts for different services on the system
 - /etc/init – Directory containing configuration files used by Upstart. The configuration files tell Upstart how and when to start and stop a services

Files and directories used to administer the system

- **/sbin – Essential system binaries**

- Directory containing utilities used by users with root privileges for system administration
 - shutdown – bring the system down
 - fdisk – partition table manipulator
 - fsck – filesystem check and repair utility
 - Runs automatically at boot time when the OS detects an inconsistent filesystem, after a crash or power loss
 - Or periodically by the admin as preventive maintenance
 - halt – stop the system
 - ifconfig – configure a network interface
 - reboot – restart the system

Files and directories used to administer the system

- **/var – Variable data**

- Directory storing administrative files such as log files and temporary files used by utilities
- /var/log – Directory that stores system logs files
 - The rsyslogd daemon listens for log messages and stores them in the /var/log hierarchy
 - The /etc/rsyslog.conf file stores configuration information for rsyslogd while the /etc/rsyslog.d/50-default.conf file stores default rules for rsyslogd

File types

- Ordinary files
 - An ordinary file stores user data, such as textual information, programs, or images

```
$ file /etc/passwd
/etc/passwd: ASCII text
$ ls -l /etc/passwd
-rw-r--r-- 1 root root 1152 2011-11-22 03:23 /etc/passwd
$
```

- Directory
 - A directory is a standard-format disk file that stores information, including names, about ordinary files and other directory files

```
$ file /media/cdrom/
/media/cdrom/: directory
$ ls -l /media/
...
dr-xr-xr-x 3 4294967295 4294967295    92 2011-10-06 01:07 cdrom
$
```

File types

- Symbolic links
 - Files that point to another files, i.e., ordinary files, directories, and devices

```
$ file /dev/cdrom1
dev/cdrom1: symbolic link to `sr0'
$ ls -l /dev/cdrom1
lrwxrwxrwx 1 root root 3 2011-11-30 13:52 /dev/cdrom1 -> sr0
$
```

File types

- Device Files
 - Interface for a device driver that appears in a file system as if it were an ordinary file
 - Block devices
 - Devices that move data in the form of blocks

```
$ file /dev/sda
/dev/sda: block special
$ ls -l /dev/sda
brw-rw---- 1 root disk 8, 0 2011-11-30 13:50 /dev/sda
$
```

- Character devices
 - Devices through which the system transmits data one character at a time

```
$ file /dev/null
/dev/null: character special
$ ls -l /dev/null
crw-rw-rw- 1 root root 1, 3 2011-11-30 13:17 /dev/null
$
```

Mounting and unmounting a filesystem

- Mounting process
 - Inform the operating system where in the directory tree a specific filesystem will appear
 - The directory given to the operating system is called mount point
 - The /media directory is intended specifically for use as a mount point for removable media
 - Generally, only the users with root privileges are authorized to mount file systems
- Unmounting process
 - Remove a specific filesystem from the directory tree
 - Automatically performed on shutdown

Mounting and unmounting a filesystem

- /etc/fstab
 - File containing a list of local or remote filesystems
 - A filesystem can be mounted automatically when the system boot
 - Or, mounted later by users with root privileges
 - A filesystem can only be mounted if:
 - There is mount point, i.e., a directory at which a new filesystem is made accessible

```
$ sudo mount /media/cdrom
mount: can't find /media/cdrom in /etc/fstab or /etc/mtab
$ cat /etc/fstab
# /etc/fstab: static file system information.
...
#/dev/cdrom1          /media/cdrom        auto                ro,user,nosuid,noauto 0 0
...
$ sudo mount /dev/cdrom1 /media/cdrom
mount: block device /dev/sr0 is write-protected, mounting read-only
$
```

Mounting and unmounting a filesystem

- mount utility
 - Attaches a filesystem to the file hierarchy
- umount utility
 - Detaches the file system from the file hierarchy

```
$ cat /etc/fstab
# /etc/fstab: static file system information.
...
/dev/cdrom1          /media/cdrom        auto                ro,user,nosuid,noauto 0 0
...
$ sudo mount /media/cdrom
mount: block device /dev/sr0 is write-protected, mounting read-only
$ sudo umount /media/cdrom
$ sudo mount /dev/cdrom1 /media/cdrom
mount: block device /dev/sr0 is write-protected, mounting read-only
$ mount
...
dev/sda1 on / type ext4 (rw,errors=remount-ro)
/dev/sr0 on /media/cdrom type iso9660 (ro)
$ ls -l /dev/cdrom1
lrwxrwxrwx 1 root root 3 2011-11-30 05:06 /dev/cdrom1 -> sr0
$
```

Mounting and unmounting a filesystem

- Mounting and unmounting a USB flash memory

```
$ sudo fdisk -l | grep sdb
Disk /dev/sdb: 3997 MB, 3997171712 bytes
/dev/sdb1  ?   778135908  1919645538  570754815+  72  Unknown
/dev/sdb2  ?   168689522  2104717761  968014120   65  Novell Netware 386
/dev/sdb3  ?   1869881465 3805909656  968014096   79  Unknown
/dev/sdb4  ?   2885681152 2885736650    27749+    d  Unknown
$ sudo mount /dev/sdb /media/external
$ ls /media/external
A Serious Computer Game to Assist Tai Chi Training for the Elderly TO APPEAR.pdf
SEGAH2011.pdf
~$SegahTaiChiGame.pptx
SegahTaiChiGame.pptx
$ sudo umount /dev/sdb /media/external
$ ls /media/external
$
```

