File Systems:

File Attributes:

Viewing file attributes

chmod: change permissions

chown: change ownership and group

umask: assign default permissions

Linux Journaling file systems

File Attributes:

setuid and setgid bits - octal 4000, 2000 - allow programs to access files and processes that are otherwise off limits when a command is executed that has setuid or setgid bit set, the effective UID or GID of the resulting processcan be set to the UID or GID of the file containing the program image rather than the UID and GID of the user that ran the command. The user's priviliges are "promoted" for execution of that command only

Permission bits - nine bits used to determine operations allowed on file.

Viewing File Attributes: using ls -l

```
kal:13:41:27:/etc$ls -l
File       Lnk owner   group    size  date         name
type/mode  Cnt
-rw-r--r--   1 root    wheel     753 Jul 14  2002 6to4.conf
drwxr-xr-x  14 root    wheel     476 Jan 10 21:40 X11/
-rw-r--r--   1 root    wheel     515 Jul 14  2002 afpovertcp.cfg
-rw-r-----   1 root    admin    4876 Aug 19 21:15 authorization
-rw-r--r--   1 root    wheel      59 Jul 14  2002 bashrc
-r--r--r--   1 root    wheel     296 Jul 14  2002 crontab
-rw-r--r--   1 root    wheel     189 Jul 14  2002 csh.cshrc
-rw-r--r--   1 root    wheel      83 Jul 14  2002 csh.login
-rw-r--r--   1 root    wheel      39 Jul 14  2002 csh.logout
drwxr-xr-x  14 daemon  admin     476 Dec 15 02:22 cups/
lrwxr-xr-x   1 root    wheel      24 Jan 27 16:19 daily@ -> periodic/daily/500.daily
drwxr-xr-x   3 root    wheel     102 Jul 14  2002 defaults/
```

Output for a device

```
kal:13:41:41:/etc$ls -l /dev/tty
crw-rw-rw-  1 root  wheel  2, 0 Feb  1 22:07 /dev/tty
```

```
drwxr-xr-x  14 root    wheel     476 Jan 10 21:40 X11/
```

First char indicates file type

File Type	Symbol	Created By	Removed By
Regular File	-	editors, cp, etc	rm
Directory	d	mkdir	rmdir, rm -r
Character Device File	c	mknod	rm
Block Device File	b	mknod	rm
UNIX Domain Socket	s	socket(2)	rm
Named Pipe	p	mknod	rm
Symbolic Link	l	ln -s	rm

The next nine are three sets of permission bits – owner–group–other

chmod: change permissions

Ex: chmod 711 myprog

```
gives all permissions to owner and execute to everyone else.
```

Permission encoding for chmod

Octal	Binary	Perms	Octal	Binary	Perms
0	000	---	4	100	r--
1	001	--x	5	101	r-x
2	010	-w-	6	110	rw-
3	011	-wx	7	111	rwx

chmod mnemonic syntax

Spec	Meaning
u+w	Adds write permission for the owner of the file
ug=rw,o=r	Gives r/w permission to owner and group, and read permission to others
a-x	Removes execute permission for all categories
ug=srx,o=	Makes the file setuid, and setgid and gives r/x permission to owner and group only

Ex: chmod -R g+w mydir

```
adds group write permission to mydir and all its contents
```

chown: change ownership and group

changes a file'd ownership in form user.group

To change a file's group you must either be the owner, or belong to the group, or su
you must be su to change a file's owner.

chown -R matt.staff ~matt

umask: assign default permissions

sets default permissions for new files created

-

Octal	Binary	Perms	Octal	Binary	Perms
0	000	rwx	4	100	-wx
1	001	rw-	5	101	-w-
2	010	r-x	6	110	--x
3	011	r--	7	111	---

Ex: umask 027

allows all permissions for the owner, forbids write to group, and no permissions for others

Linux File Systems

Filesystem Implementations

EXT2 – Linux Default

Linux Journaling file systems

EXT3	**Journaling enhancement compatible with ext2**
Reiser FS	**Open source Journaled filesystem project**
JFS	**IBM's Journaled Filesystem**
XFS	**SGI's Journaled Filesystem**

Why use Journal file system?

A journaling file system can simplify restarts, reduce fragmentation, and accelerate I/O. Better yet, journaling file systems make fscks a thing of the past.

A comparison of journaling file systems

Kernel support	Ext3	ReiserFS	XFS	JFS
Kernel prerequisites	No	No	Yes	No
In kernel.org source tree 2.4.Ix	2.4.15	2.4.1	–	–
In kernel.org source tree 2.5.Ix	2.5.0	2.5.0	–	2.5.6
License	GPL	GPL	GPL	GPL
Features				
Largest block size supported on ia32	4 Kb	4 Kb	4 Kb	4 Kb
File system size maximum	16384 Gb	17592 Gb	18,000 Pb+	32 Pb
File size maximum	2048 Gb	1 Eb*	9,000 Pb	4 Pb
Growing the file system size	Patch	Yes	Yes	Yes
Access Control Lists	Patch	No	Yes	WIP
Dynamic disk inode allocation	No	Yes	Yes	Yes
Data logging	Yes	No	No	No
Place log on an external device	Yes	Yes	Yes	Yes
Distros with journaling file systems				
Red Hat 7.3	Yes	Yes	No	Yes
SuSE 8.0	Yes	Yes	Yes	Yes
Mandrake Linux 8.2	Yes	Yes	Yes	Yes
Slackware Linux 8.1	Yes	Yes	Yes	Yes

+ Pb is petabyte, or 10^{15} bytes

* Eb is exabyte or 10^{18} bytes

Switching to Ext3

If you want to switch to Ext3, it's a good idea to make a backup of your file systems. Once you've done that, run the tune2fs program with the -j option to add a journal file to an existing Ext2 file system. You can run tune2fs on a mounted or unmounted Ext2 file system. For instance, if /dev/hdb3 is an Ext2 file system, the command

 # tune2fs –j /dev/hdb3

(When you mount an Ext3 file system, the .journal file will appear. The .journal file is just an indicator to show that the file system is indeed Ext3.)

Next, the entry for /dev/hdb in /etc/fstab needs to be changed from ext2 to ext3. The final step is to reboot and verify that the /dev/hdb3 partition has type ext3. Type mount. The output should include an entry like this one:

% mount

/dev/hdb3 on /test type ext3 (rw)

Network based file systems

NFS Network Filesystem (SUN)

CIFS Windows netork FS (Samba)

AFS Andrew Filesystem (OpenAFS)

AFS is a distributed filesystem product, pioneered at Carnegie Mellon University. It offers a client–server architecture for file sharing, providing location independence, scalability and transparent migration capabilities for data.

References:

Linux Administration Handbook - Nemeth, Synder, Hein
Chapter 5, pgs 73 - 80

Linux Magazine / October 2002 / FEATURES Journaling File Systems
http://www.linux-mag.com/2002-10/jfs_01.html

OpenAFS - http://www.openafs.org