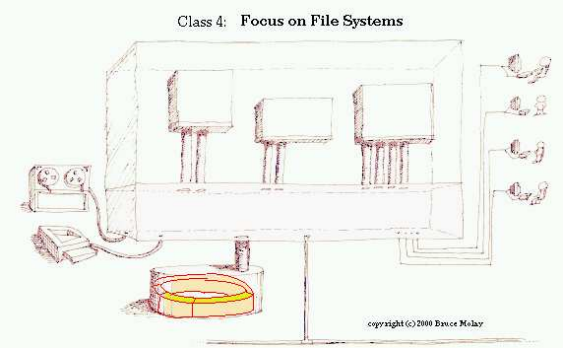
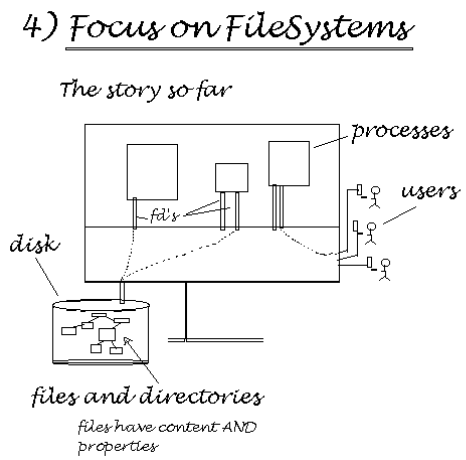
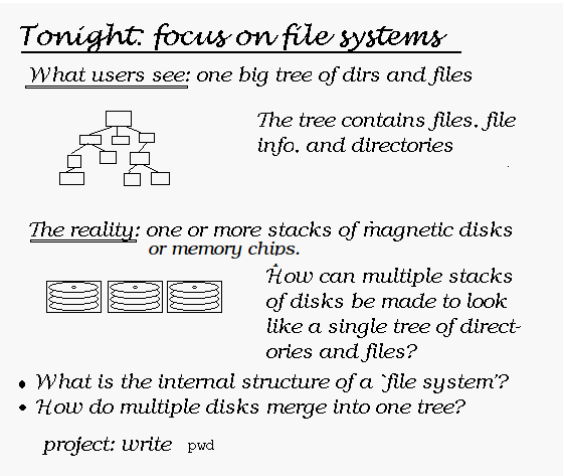
page000.html **000**



page001.html **Directory Trees and Disks** **001**



page002.html **002**



page003.html

perror and errno

003

2) But first, a brief interruption to discuss error handling

errno (error code) perror(char *) (prints a message) strerror(errno) (returns a string)

Fact: system calls return -1 on error
But: what *is* the specific error ?
example: open() can fail for many reasons

Q: How can the program determine which error it is?
A: The kernel sets a global value, known as errno, to a code in /usr/include/errno.h
Q2: How can a program tell the user what is the cause of the error?
A2: perror(str) prints "str: description"

Q3: What to do?
A: it depends

perror_demo.c

page004.html

User View of Directories

004

3) User view and Commands for file system

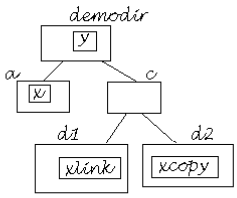
first, let's become familiar with the major fs-related commands by building a demo directory tree

commands

mkdir rmdir cd pwd

cat cp rm mv ln

du
ls -la
ls -R



page005.html

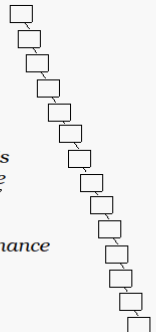
005

4) Almost no limits to tree structure

- directories can contain lots of files
- directory depths can exceed the capacity of most fs commands

Ex. dig

```
while true
do
    mkdir s
    cd s
done
```



What does du do with this directory structure? Or tree ls -lR, find, ... ?

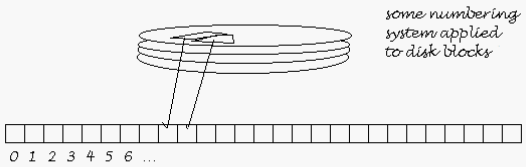
Note: some system maintenance tools might fail on these.

see also: dig_verbose

page006.html **Structure of a File System** **006**

5) Face Reality: a disk is not a tree
we are not `in' a directory

6) A disk is a stack of magnetic platters, disks, tracks, sectors, viewable as a sequence of DISK BLOCKS

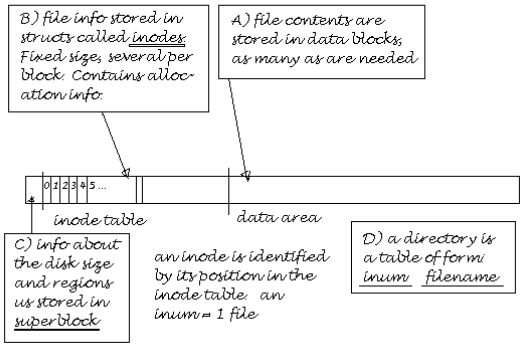


A 'disk' can also be a USB flash drive, the storage on a telephone, or storage device that consists of a sequence of blocks.

page007.html **007**

7) How can a numbered sequence of blocks store files, file info, and directories ?

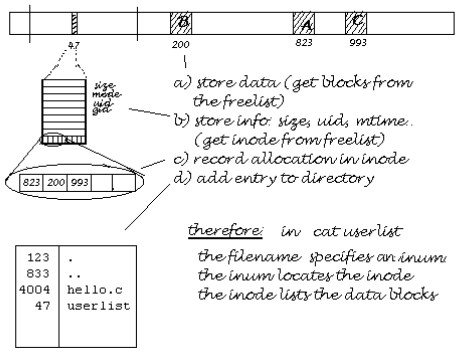
Ans: divide the disk into three regions, structure them sp:



page008.html **Block Allocation Lists** **008**

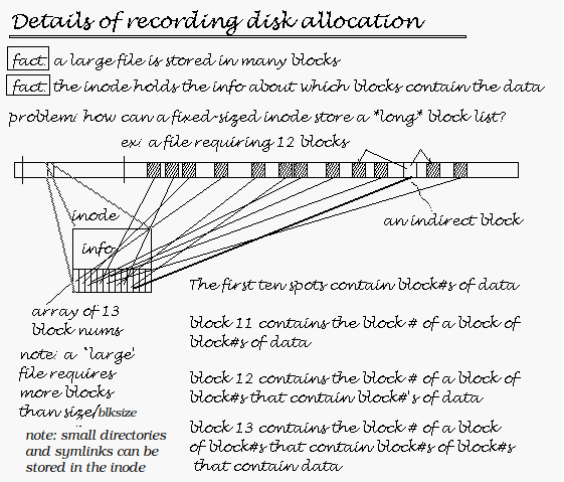
8) Using this model to understand creating a file: e.g. who > userlist

say the file requires three disk blocks of storage...

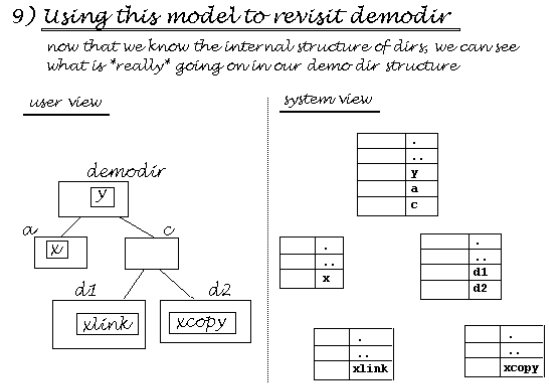


therefore: in cat userlist
the filename specifies an inum
the inum locates the inode
the inode lists the data blocks

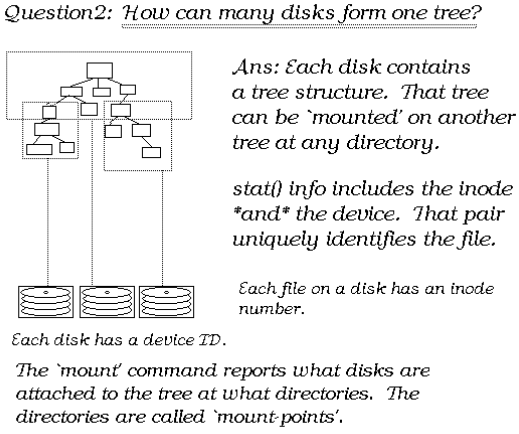
page009.html **Details of Allocation Lists** **009**



page010.html **010**



page011.html **Multiple disks, one tree** **011**



page012.html

012

10) The System Calls for standard file ops

command	syscall	action
rm	unlink()	removes a link if links == 0, deallocate
rmdir	rmdir()	delinks a directory
ln	link()	creates a new link
mv	link() then unlink() now rename()	
mkdir	mkdir()	creates new directory

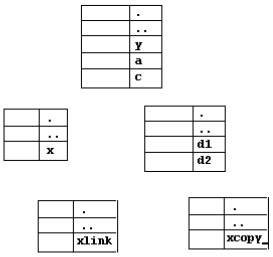
page013.html

Writing pwd

013

11) writing pwd

pwd prints the path to the current directory. But, the current directory only knows itself as "." How can its location in the tree be determined?

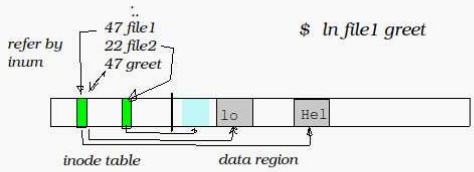


page014.html

Multiple Names for Same File

014

Hard Links: Different Names for the Same File



One file: two dir entries (i.e. two links)

You can use either name. chmod o+x file1, chmod u-r greet

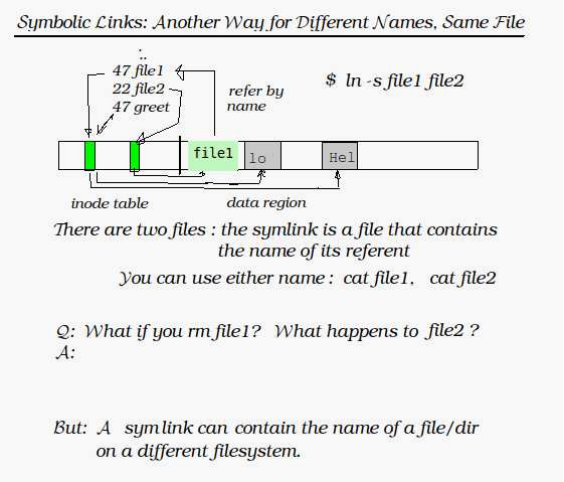
Q: What if you rm file1? What happens to greet?
A:

Note: In a city, each street has its own list of house numbers
Each file system has its own inode table (inums

But: A hard link cannot refer to an inode on a different file system. 123 Main St vs 123 Maple St

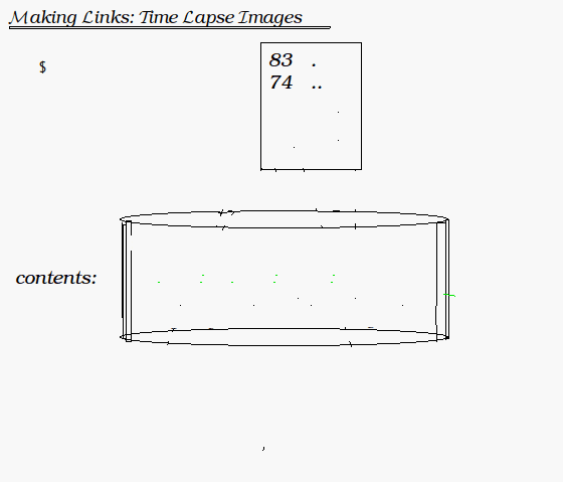
page015.html

015



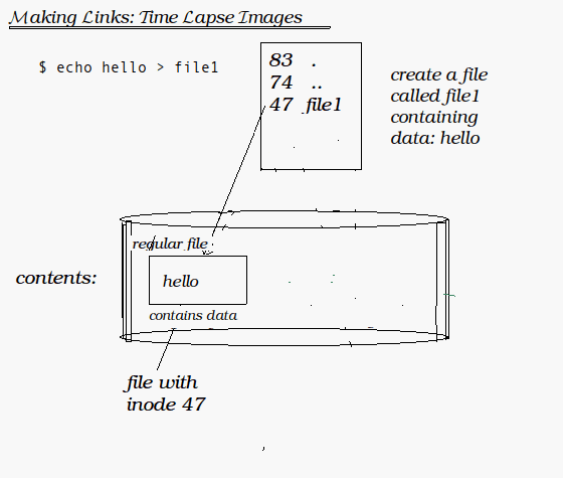
page016.html

016



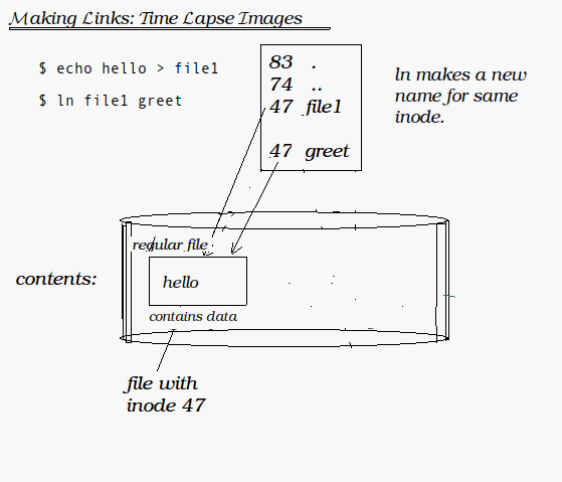
page017.html

017



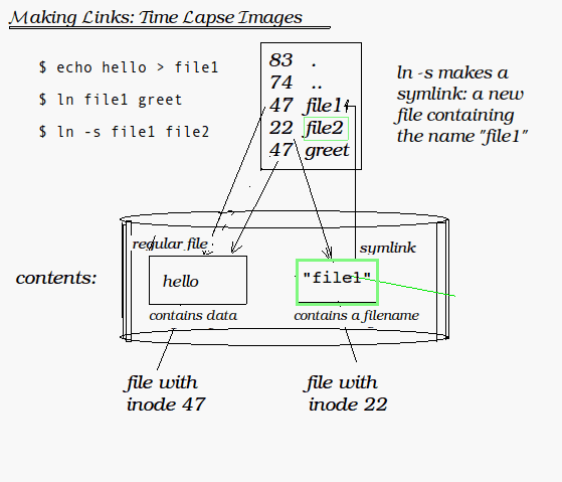
page018.html

018



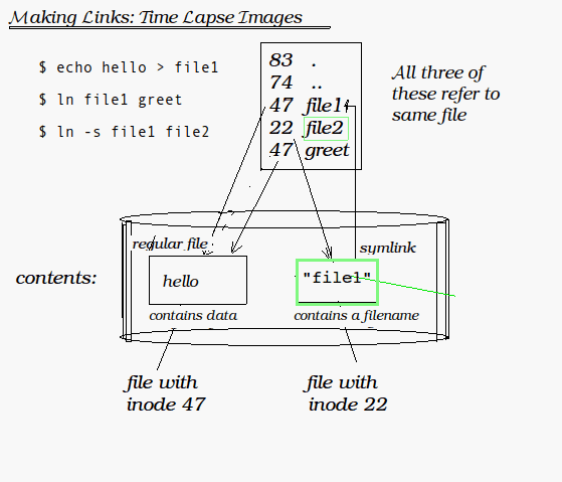
page019.html

019



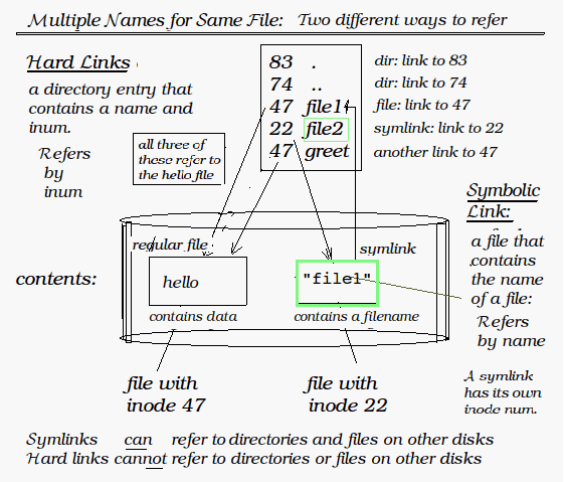
page020.html

020



page021.html

021



page022.html

022