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FIPS Federal Information Processing Standard. Requires some features that Posix has as optional.

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Use the following to obtain an explanatory message:

perror("optional leader string") to print to stdout or

strerror("optional leader string") to return a string

Unix Limits

APIs and user programs often run under limitations

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Query functions include

sysconf()	non-file/directory limit
fpathconf()	file/directory related limit (filedes)
pathconf()	file/directory related limit (char*)

Using Unix Limit Functions

```
#include <unistd.h>
long sysconf(int name);
long pathconf(const char *pathname,int name);
long fpathconf(int fildes,int name);
```

All three functions return -1 and set `errno` upon failure.

name	*description*
_PC_MAX_CANON	: must be a terminal "file"
_PC_MAX_INPUT	: must be a terminal "file"
_PC_MAX_DISABLE	: must be a terminal "file"
_PC_LINK_MAX	: can be a file or directory
_PC_PATH_MAX	: must be a directory
_PC_APE_BUF	: must be a pipe, fifo, directory
	: (if directory, any fifo in that directory)
_PC_CHOWN_RESTRICTED	: must be either a file or a directory

(see more limits on website) (see seelimits.c)

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Named Pipes	(p)	Interprocess communications.

(the letter in parentheses is shown by ls -lsa)

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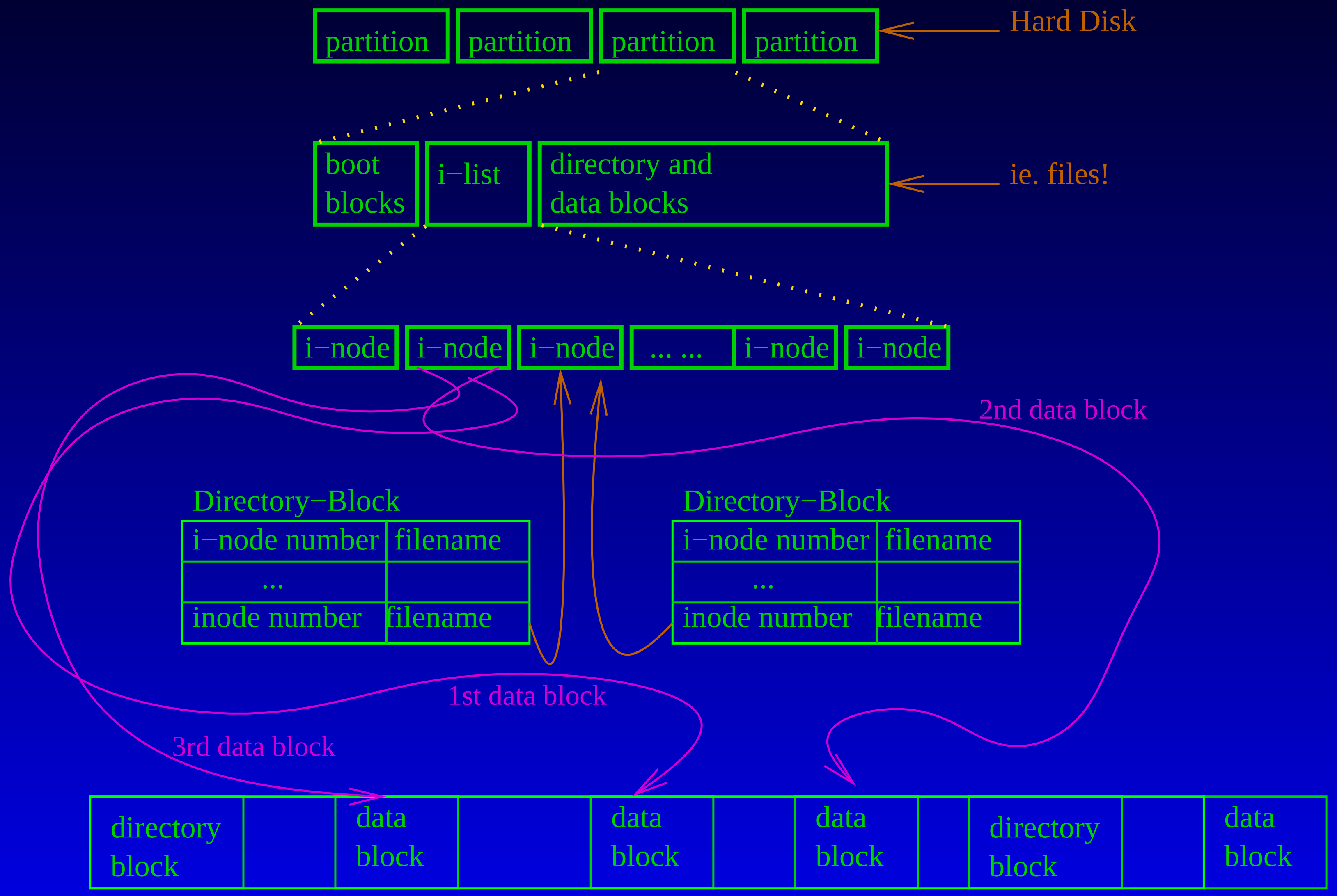

Directory−Block

i−node number	filename
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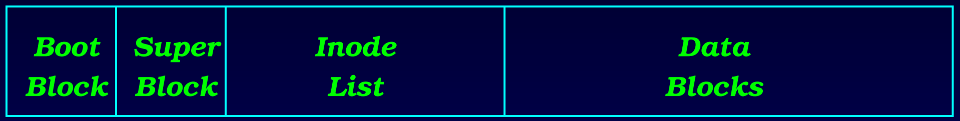

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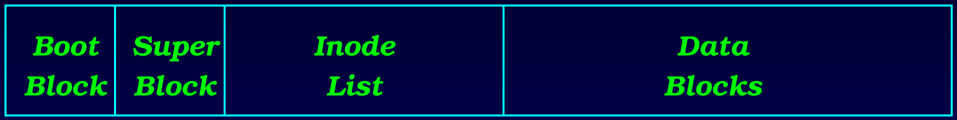

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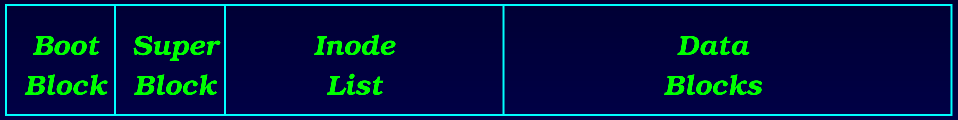

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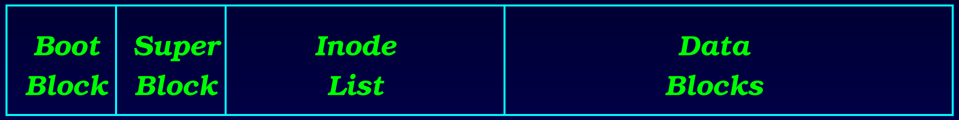

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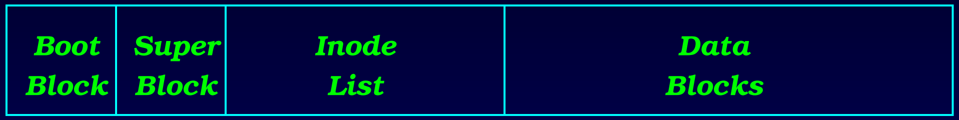

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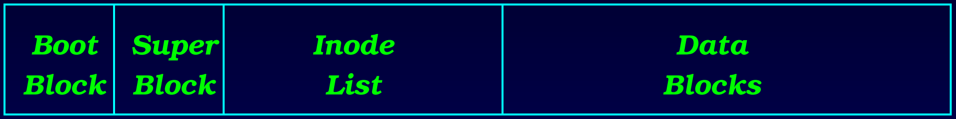

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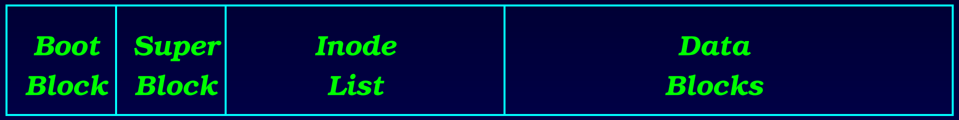

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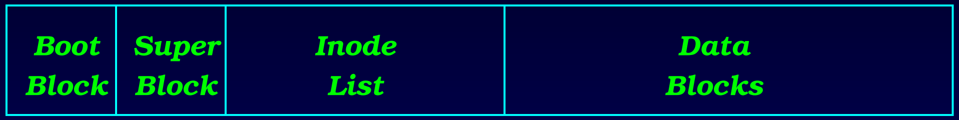

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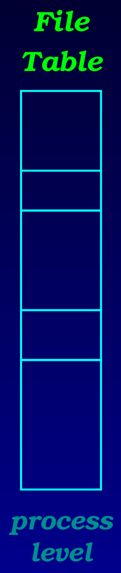

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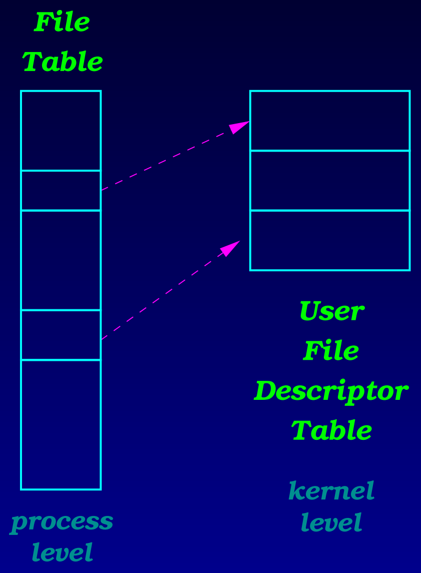

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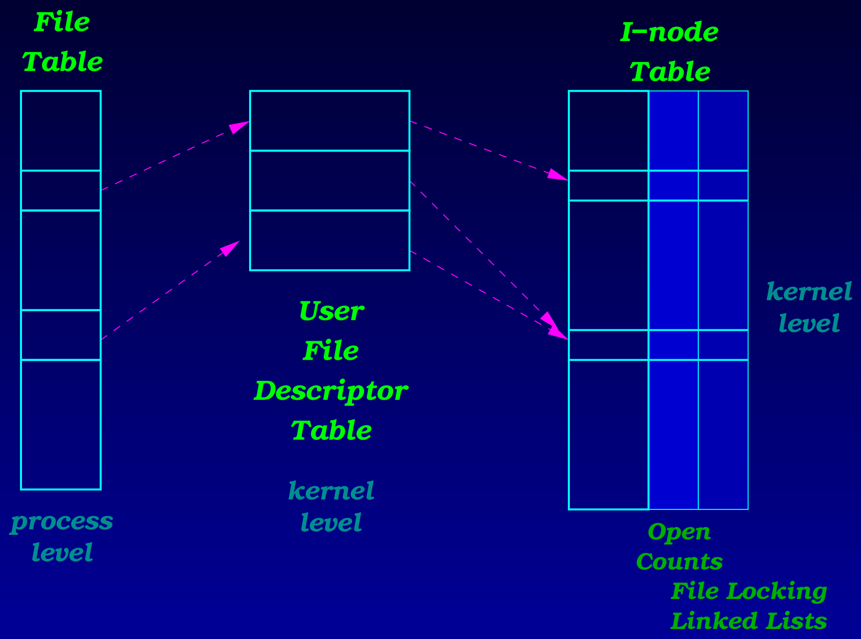

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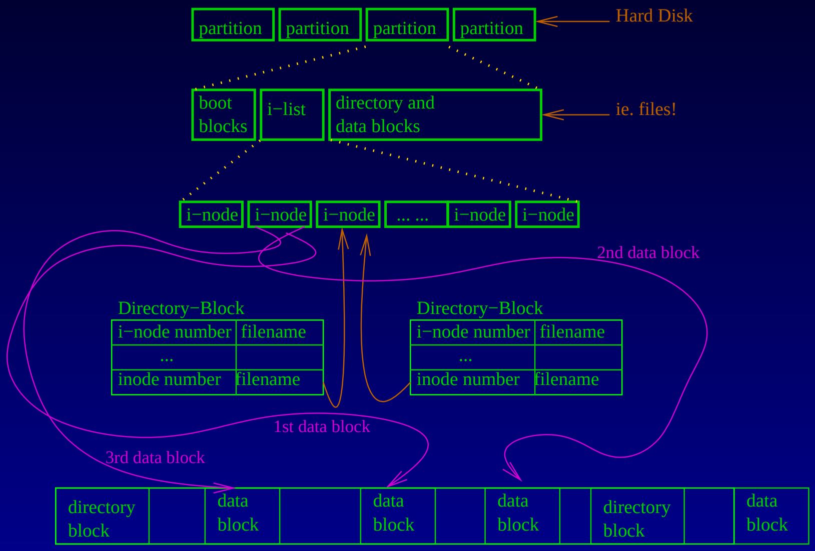
User File Descriptor Table (*kernel level*) Holds indices into the user file descriptor table. Every open file has an entry in this kernel-level table.

i-node Table (*kernel level*) Describes the file permissions, etc, and indexes associated data blocks.

Unix Filesystem: Inodes



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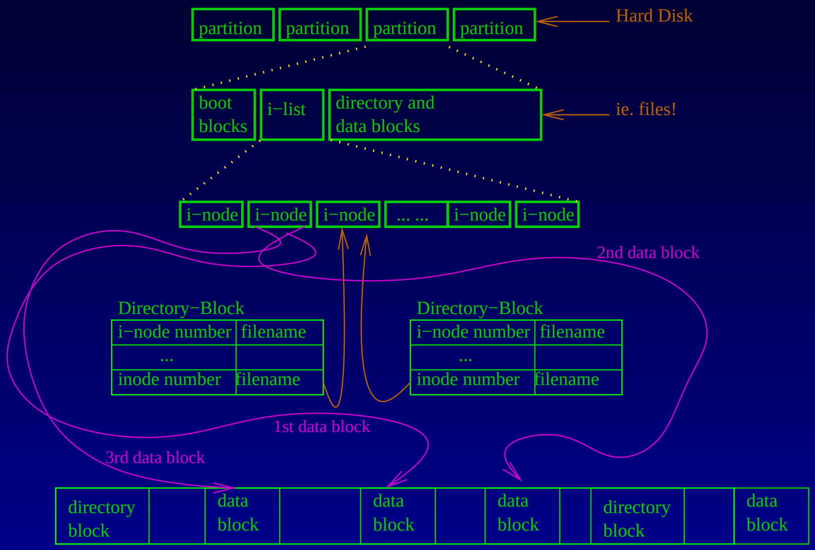

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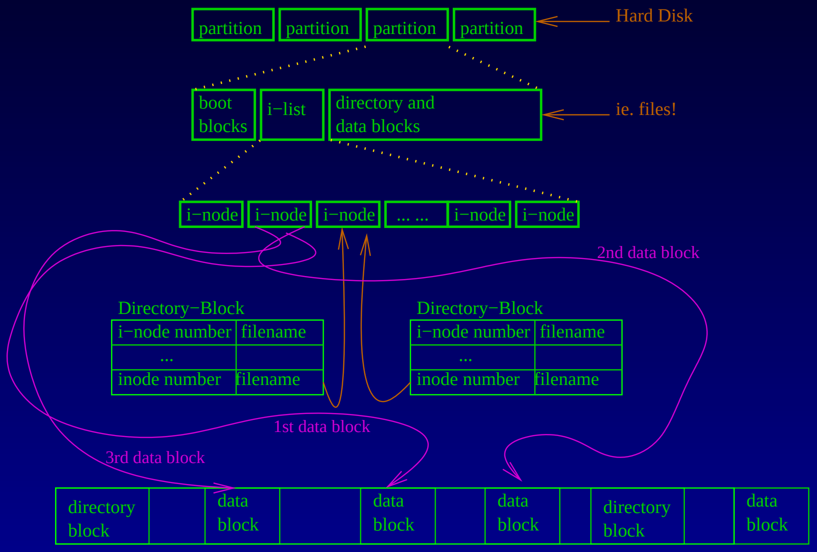

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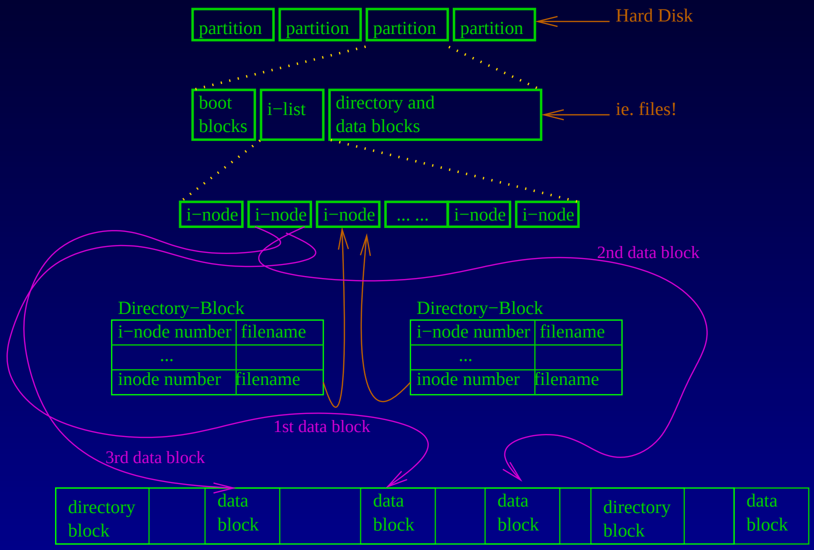

partition partition partition partition

Hard Disk

boot blocks

i-list

directory and data blocks

ie. files!

i-node i-node i-node ... ... i-node i-node

2nd data block

Directory-Block

i-node number	filename
...	
inode number	filename

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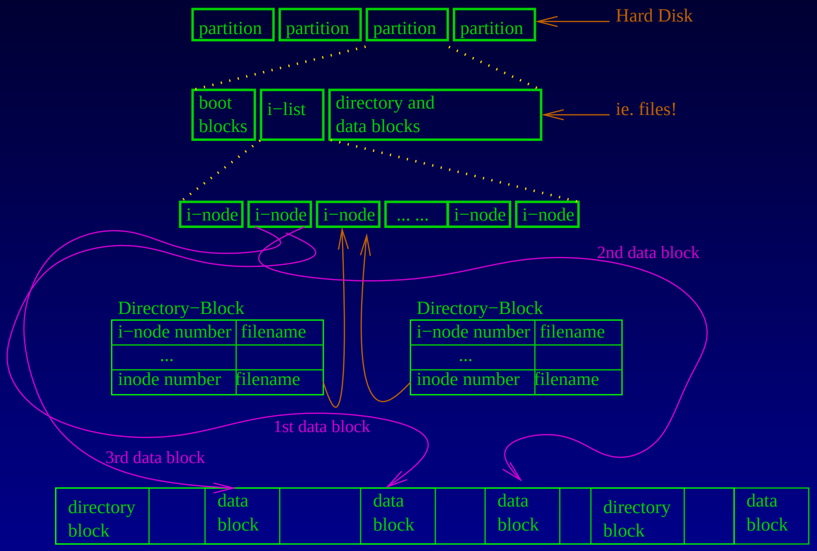

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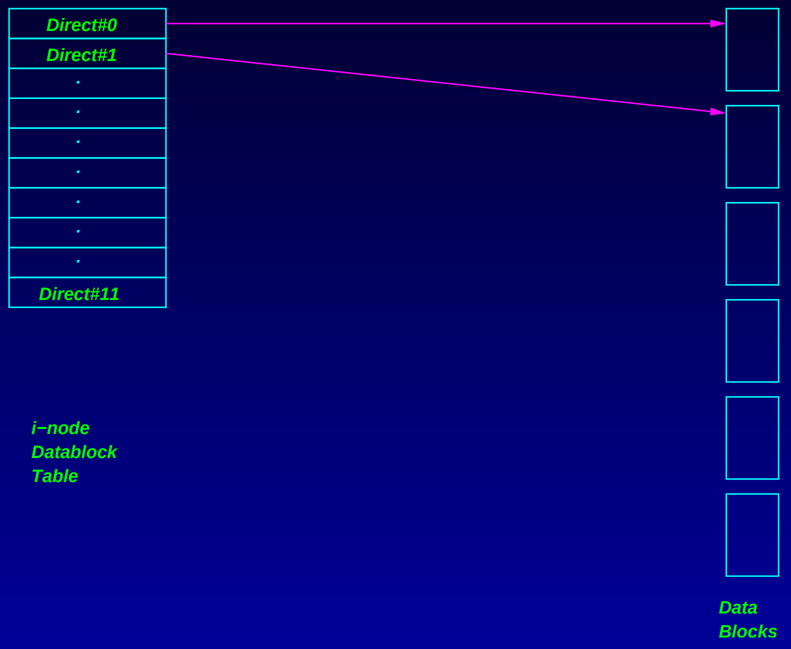
- Use df -i to determine the quantities of used and free i-nodes on your system.

Inodes and Data Blocks



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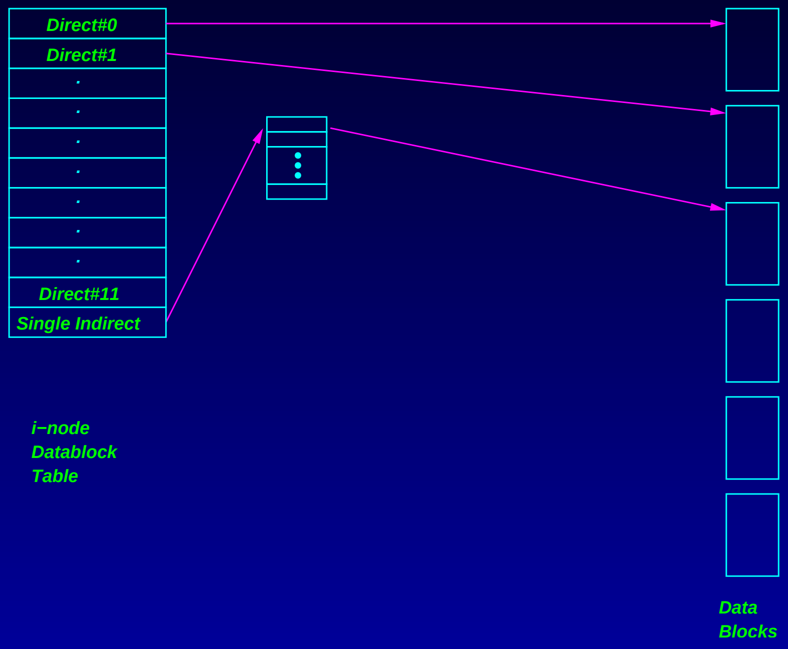

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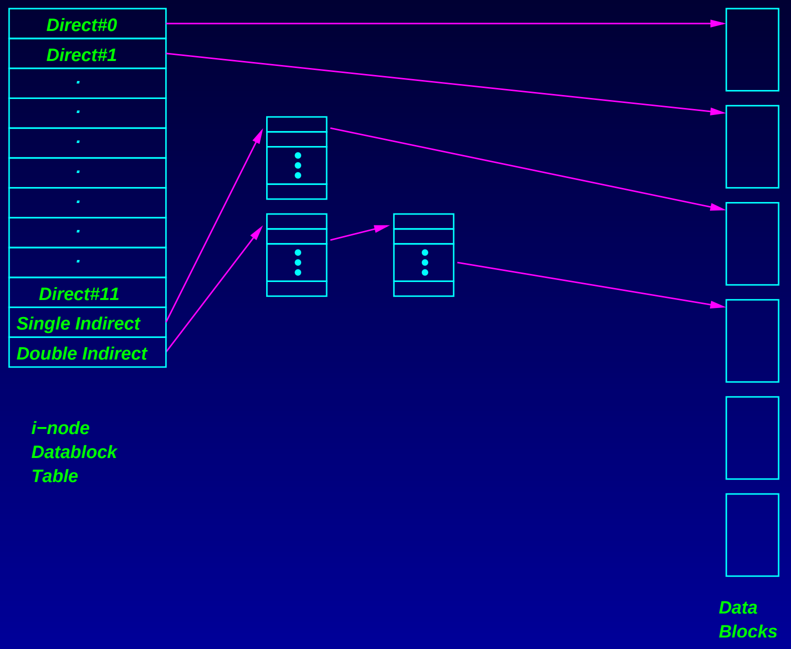

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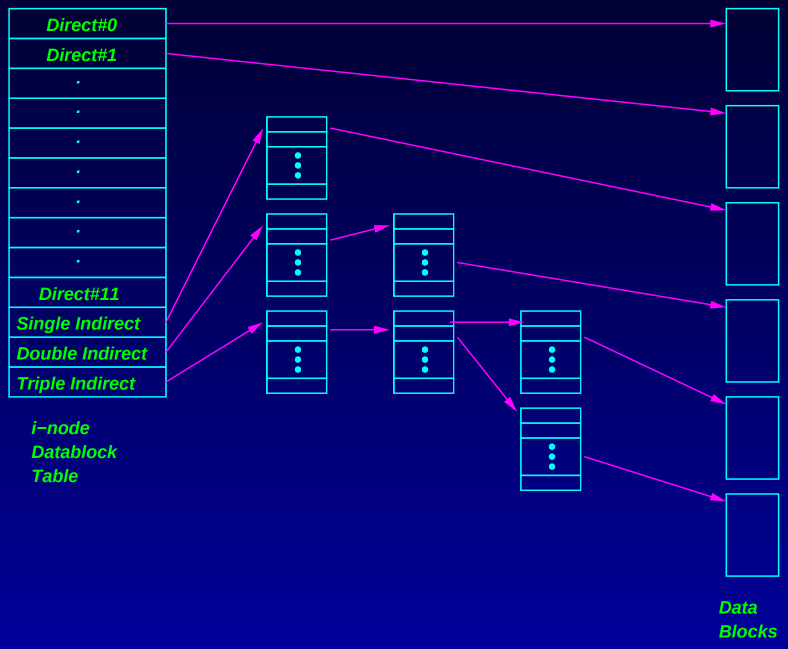

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- Finally, if the double indirect slots are exhausted, the **triple indirect** indexing is used.

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These two uses of mknod are available *only to the superuser*

(*the superuser is the system administrator; ie. root*)

Understanding /etc/fstab

or, *how to mount filesystems*

The format of fstab will resemble:

filesystem	*mount point*	*type*	*options*	*frequency*	*passno*
block device	directory	ext3	rw	1=dumping support	controls fsck
remote filesystem	path	ext2	ro	0=no dumping	0=no check
		ntfs	noauto		1=root fs
		proc	grpid		2=other fs
		vfat	nodev		
		(etc)	raw		
			(etc)		

(check the mount command for more on this)

/etc/fstab: an example

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/dev/mapper/vg_xorn-lv_home /home ext4 defaults 1 2
```

/dev/mapper/vg_xorn-lv_home   This device actually is linked to /dev/dm-2.
These are block-oriented, read-write drivers.

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defaults	Default filesystem settings For Ext3 file systems: equivalent to rw,suid,dev,exec,auto,nouser,async
1	dump frequency controls archiving schedule for the partition (see man dump)
2	Controls the order in which fsck checks the device/partition for errors at boot time. The root device should be 1. Other partitions should be either 2: to check after root or 0: to disable checking for that partition altogether.

Device Names

/dev/fd0	first floppy disk drive
/dev/fb0	first framebuffer drive. The framebuffer is a character device and is on major node 29 and minor 0.
/dev/hda	The master IDE drive on the primary IDE controller.
/dev/hdb	The slave drive on the primary controller.
/dev/hdc	and /dev/hdd are the master and slave devices on the secondary controller.
/dev/ht0	First IDE tape drive
/dev/js0	First analog joy stick (subsequent ones are /dev/js1, /dev/js2, etc). They are character devices on major node 15. The analogue joysticks start at minor node 0 and go up to 127. Digital joysticks start at minor node 128.
/dev/loop0	first loopback device
/dev/lp	line printer
/dev/md0	First metadisk group. Metadisks are related to RAID (Redundant Array of Independent Disks) devices. (see http://www.tldp.org/HOWTO/Software-RAID-HOWTO.html). It is a character device on major node 14, minor node 0.
/dev/mixer	part of the OSS (Open Sound System) driver (see http://www.opensound.com)
/dev/null	the bit bucket/trashcan. It is a character device on major node 1, minor node 3.

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Block devices on major node 45. Minor nodes:
The first device is /dev/pda and it is on minor node 0.

/dev/pcd0 — parallel port CD ROM drive. These are numbered from 0 onwards.
All are block devices on major node 46.
/dev/pcd0 is on minor node 0; subsequent drives use minor nodes 1, 2, 3 etc.

/dev/pt0 — Parallel port tape devices. Tapes do not have partitions so these are just numbered sequentially. They are character devices on major node 96.
The minor node numbers start from 0 for /dev/pt0 , etc.

/dev/parport0 — The raw parallel ports. Most devices needing parallel ports have their own drivers. This device permits direct access to the port.
It is a character device on major node 99 with minor node 0.
Subsequent devices after the first are numbered sequentially, incrementing the minor node.

/dev/random or /dev/urandom — These are kernel random number generators.
/dev/random is a non-deterministic generator (cannot guess next number)
/dev/urandom works similarly, but will return numbers using pseudo-random number generator after system entropy is used up.

Device Names , con’t.

/dev/sda The first SCSI drive on the first SCSI bus. The following drives are named similar to IDE drives. /dev/sdb is the second SCSI drive, /dev/sdc is the third SCSI drive, and so forth.

/dev/tty## terminals

/dev/ttyS0 The first serial port. Many times this it the port used to connect an external modem to your syster

/dev/ttyUSB USB serial converters, modems

/dev/zero This is a simple way of getting many 0s. Every time you read from this device it will return 0. This can be useful sometimes, for example when you want a file of fixed length but don’t really c

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or, *what's in an inode anyway?*

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These attributes are assigned by the kernel when the file is created.

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System Calls functions invoked internally by some program

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2. Kernel has an i-node table (permissions, times, data block indexing)
3. Kernel also creates and manages processes.

   Processes have considerable amounts of associated information: memory, file descriptors, shared memory, environment variables, etc. In particular, processes have a *file descriptor table*.

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      i. Process file descriptor slot points to kernel file table slot
      ii. File table entry points to inode table where inode record is stored
      iii. File table entry gets current file pointer of open file; ie. a count of bytes from the beginning of the file (see ftell).

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         Counts qty of file descriptors from any process that are accessing the file.
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Once open() succeeds, one may read(), write(), and close() the file.

File descriptors index the file descriptor table → the kernel's file table.

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7. Returns success (0)