deft User Guide

Stefano Fratepietro, Sandro Rossetti

R. 0,6
This manual is dedicated to Ele and Silvia: thank you for your infinite patience.

It's also dedicated to “bubu” and “Paguro”, we really hope that they will resemble more their mothers than their fathers.
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Authors

**Stefano "YoungSTEr" Fratepietro** graduated in 2006 in Information Technology and Management (Internet Science) at the University of Bologna with a thesis in Computer Forensic entitled "A case study of the virus Vierika". certificate ISECOM OPST currently is a security specialist at the Office of IT Security CSE (Banking Association). He carries out activities as Digital forensic expert for tribunals, law enforcement agency and private company. In Italy, he was involved, as adviser, in cases of national fame as "Good morning!Vitaminic" and "Pirelli-Telecom-Ghioni". Since 2005 he is the creator and project leader of the DEFT team. Occasionally performs teaching activities on Computer Forensics for Italian universities and private courses. He's member of the IISFA (Italian Chapter) since 2008.

**Sandro "bUSBoy" Rossetti**
Alessandro Rossetti lives and works in Rome. Most of his personal interests are into Information Technology, focusing on security and forensic issues. He is a member of several independent organizations such as ISACA (Board of Directors of the Rome Chapter), IACIS and IISFA (Italian Chapter).
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Introduction

We want to provide y this manual a basic understanding about the key features of the DEFT Live distro.

It thus represents a starting point from which you can draw inspiration and a stimuli to growth your technical expertise.

These pages will not provide (for now) a depth description of each application and hot to use every command included. We have included a few examples to suggest you how to perform some of the main activities of Digital Forensic such as acquisition, preservation, analysis and management of cases involving mass storage (hard drives, USB sticks, MP3 players) and/o traffic over IP networks.

Finally we wish to thank the people who handled the review phase of the manual:

NO ONE!!!

THANK YOU!

Have fun!
DEFT Linux live CD

Applications List

DEFT Linux

sleuthkit 3.2.0
autopsy 2.24
FDF 0.8
dhash 2.0.1
aff lib 3.6.4
Disk Utility 2.30.1
guymager 0.5.7
1.14 dd rescue
dcfldd 1.3.4.1
dc3dd 7
Foremost 1.5.6
photorec 6.11
mount manager 0.2.6
scalpel 1.60
Wipe 00:21
hex dump
outguess 0.2
ophcrack 3.3.0
DEFT Xplico 0.6.1 edition
wireshark 1.2.11
ettercap 0.7.3
nmap 5.21
dmraid
testdisk 6.11
ghex, light gtk hex editor
Vinette 0.6

TriD 2:02 DEFT edition
readpst 0.6.41
chkrootkit
rkhunter 1.3.4
john 1.7.2
catfish
1.0 biscuit
Pasco 1.0
md5sum
sha1sum
sha224sum
sha256sum
sha512sum
md5deep
sha1deep
sha256deep
Skype log view
Xnview
xmount 0.4.4
IE, Mozilla, Opera and Chrome cache viewer
IE, Mozilla, Opera and Chrome history viewer
Index.dat file analyzer
pdfcrack cracking tool
fcrackzip cracking tool
Clam AntiVirus 4.15
mc

DEFT Extra

WinAudit 2.28.2
MITEC Windows Registry Recovery 1.5.1.0
Zeroview 1.0
FTK Imager 3
Nigilant32 0.1
Windows Forensic Toolchest 3.0.05
MoonSols Win32dd 1.0.2.20100417
MoonSols Win64dd 1.0.2.20100417
Windows File Analyzer 1.0
UltraSearch 1:40
Pre-Search xx.08
XnView 1.97.8
X-AgentRansackk 2010 (build 762)

SmartSniff x86 and x64 1.71
StartupRun 1.22
MyLastSearch 1:44
Mozilla Cookies View 1.30
Opened Files View 1:46
Opera Cache View 1:37
Outlook View Attack x86 and x64 1:35
Process Activity View x86 and x64 1.11
Recent Files View 1.20
RegScanner x86, x64 and win98 1.82
ServiWin 1:40
USBDeview x86 and x64 1.80
Assist 1.1 User View
Index.dat Analyzer 2.5
AccessEnum 1.2
10:03 Autoruns
DiskView 2.4
Filemon
Process Explorer 12.04
1.1 RAM Map
Regmon
Rootkit Revealer 1.71
VMMMap 2.62
WinObj 2.15
AlternateStreamView 1.15
ChromeCacheView 1.25
CurrPorts x86 and x64 1.83
CurrProcess 1.13
FoldersReport 1.21
IE Cache View 1.32
IE Cookies View 1.74
IE History View 1.50
Inside Clipboard 1.11
Live View Contacts 7.1
Mozilla Cache View 1.30
Mozilla History View 1.25
Mozilla Cookies View 1.30
Opened Files View 1:46
Opera Cache View 1.37
Outlook View Attack x86 and x64 1:35
Process Activity View x86 and x64 1.11
Recent Files View 1.20
RegScanner x86, x64 and win98 1.82
ServiWin 1:40
MUI Cache View 1.1
MyEventView 1.37
SkypeLogView 1.15
View User Profile 1.1
Video Cache View 1.78
WhatInStartup 1.25
WinPerfectView 1.10
Password Tool
ChromePass 1.10
Dialupass 3.10
IE PassView 1.20
Dump LSA Secrets x86 and x64 1.21
LSA Secrets View 1.21 x86 and x64
Mail PassView 1.65
MessenPass 1:35
Network PassRecovery x86 and x64 1.30
Opera PassView 1.1
PasswordFox 1.25
PC AnyPass 1.12
Pass Protected View 1.63
PST Password 1.12
Remote Desktop PassView 1.1
VNC PassView 2.1
Win9x PassView 1.1
WirelessKeyView x86 and x64 1:34
AviScreen Portable 3.2.2.0
Hoverdesk 0.8
File Restore Plus 3.0.1.811
WinVNC 3.3.3.2
TreeSizeFree 2:40
PCTime
LTFViewer 5.2
Sophos Anti-Rootkit 1.5.4
Terminal with command line tools
Spartakus 1.0
Testdisk 6.11.3
Photorec 6.11.3
Run the DEFT Linux live CD

First you must ensure that the configuration of the system BIOS is set to scan boot from CD-ROM/DVD-ROM or external storage devices (depending on the medium on which is DEFT installed). Once you set up the BIOS, please reboot the system with the CD-ROM already inserted into the CD/DVD driver or USB pen already connected to an USB port.

The boot loader allow you to customize:

- the deft language (by pressing F2)
- The keymap (by pressing F3)

![Changing the language](image1)

![Changing the keyboard's keymap](image2)

You can also customize a few more startup parameters, such as:
- **acpi = off or noapic**: the boot does not use ACPI functions for the power management;
- **nolapic**, disables the APIC functions for Intel CPU-based architectures;
- **edd = on**, enable the Enhanced Disk Drive;
- **nodmraid**, disable the kernel setting for dmraid raid type of software;
- **vga = xxx** sets the framebuffer resolution if your video card is in vesa mode

Deprecated parameters are represented in red, in black the parameters that showed no malfunction. For more information about these parameters, please refer to Appendix 1.
DEFT Linux text mode

after the computer boot, the system will show a text-based bash shell session with root permissions (with six terminals by the key combination ALT F1 -> F6). This implementation is very useful when - you need to start DEFT Linux on a very old computers that do not support an optimal use of the graphical interface - an advanced user who prefers to work from the command line.

Managing Storage Media

The following commands are very useful when you need to perform tasks related to the management of storage devices:

- `fdisk-l`: it list of all the partitions and storage devices connected.
- `mmls /dev/xxx` or `mmls nomefile.dd`: they list the partitions on the device or raw image indicating the starting offset and the unallocated space.
- `hdparm-lg /dev/xxx`: it shows the AC characteristics of the mass memory xxx.
- `tail-f/var/log/messages`: it display messages in real time online information, warning and debug of events that he also cover storage devices.
Mounting memories

The mount command allows you to connect a file system to a system directory. The selected file system, beside being composed of a device can be contained within a file:

- in the "bit stream image" format (raw or dd format)
- in the "Encase" format, (.ewf format)
- using "advanced forensics format" (.aff file).

In forensics, the direct mounting of an evidence should be done only when really necessary\(^1\), in the read-only mode. This ensures that the evidence will not be altered during the investigation.

**dd / raw file type**

To be able to mount file system read-only memories of physical or raw just type a command as shown in following example:

```
mount -t type -o source options mount_point
```

where:

- **type** it is the file type, vfat, ntfs-3g, ext3 ... etc., or auto when you do not know the type of file system
- **source** it may be a partition such as / dev/hda1 or / dev/sda1, or the image of a partition such as dump.dd

- **mount_point** it is usually a subdirectory of / media and it must already been created, eg. with: `mkdir / media / foldername`
- **most commonly used options** (-o):
  - `ro` - read-only: read-only mount of the file
  - `rw` - read-write: mount in writing mode (it will be use for the copy)
  - `loop` - to mount an image file
  - `noatime` - it will not change the last access dates
  - `noexec` - do not allow files execution

---
\(^1\) Best practices indicate clearly that you should NEVER work on the original Mass storage. It's strongly advice to work on copies.
offset = N - when you mount a disk image, it gives the number of bytes to jump to point to the beginning of the logical partition to mount (data recoverable with the mmls command)

Example 1: Mount in RW mode a NTFS partition on which run an acquisition.

\texttt{mount-t ntfs-3g o rw / dev/sdb1 / media / dest}

Example 2: Mount in read-only mode a NTFS partition of an image of an entire disk.

through the \texttt{losetup} command you can associate a loop device to the \texttt{image dd} file so that you can use the applications that runs on devices also on an image of mass storage device:

\texttt{losetup -r / dev/loop0 / media/disco1/dump.dd}

by the \texttt{mmls} utility you can find the first offset of a disk partition:

\texttt{mmls / dev/loop0}

and get an output like following one:

\begin{verbatim}
  DOS Partition Table
  Offset Sector: 0
  Units are in 512-byte Sectors
  Slot Start End Length Description
    00: Meta 0000000000 0000000000 0000000001 Primary Table (# 0)
    01: ------- 0000000000 000002047 000002048 Unallocated
    02: 00:00 000002048 000032255 0026624000 Unknown Type (0x27)
    03: 00:01 000032256 0086598247 0000204800 NTFS (0x07)
    05: ------- 0086598248 0976773167 0000002048 Unallocated
\end{verbatim}

We mount the partition identified as 03 from the output of \texttt{mmls} specifying the offset multiplied by 512^2:

\texttt{mount-t ntfs ro, noatime, noauto, noexec, offset = 16515072 / dev/loop0 / media / dest}

Please completed all the operations on the memory devices before disconnecting them from the system. To disconnect a memory you can use the \texttt{umount} command:

\texttt{umount / media / punto_di_mount.}

---

2 512 bytes is the default size of a sector in a mass storage.
EWF / Encase File

The mount of .EWF memory can be obtain by the `mount_ewf` app. This app, given one or more splitted files in the Encase format, converts "virtually" EWF files in raw format allowing the mount of the device like a memory acquired in the dd format.

Example: the disk01 image is divided into the following files

disk01.E01 disk01.E07 disk01.E13 disk01.E19 disk01.E02 disk01.E08 disk01.E14 disk01.E20
disk01.E03 disk01.E09 disk01.E15 disk01.info disk01.E04 disk01.E10 disk01.E16 disk01.E05
disk01.E11 disk01.E17 disk01.E06 disk01.E12 disk01.E18

The command

```
mount_ewf / media / case1/disk01.E * / tmp/disk01
```

will reconstruct the splitted image and it will perform a virtual conversion in the raw format. This operation will create the `/ tmp/disk01/disk01`, raw file in the folder `/ tmp/disk01 /`, which can be mounted following the procedure to mount memories as loop devices.

AFF File

As for the EWF format, the memories, acquired in the AFF format can be mounted thanks the `Affuse` mount utility. Affuse allows you to use acquisitions in the AFF formats as raw images.

The command syntax is:

```
Affuse / media/disk/disk01.aff / tmp/disk01 /
```

the output is the `/ tmp/disk01/disk01.aff.raw` file that can be mounted following the procedure to mount the loop device as memory.

Hash calculation

The hash of a block of data (eg a file) is a sequence of alphanumeric characters of fixed length generated by a mathematical function. Any modification of data, though minimal, will create a completely different hash.

This mathematical function is mono-directional: it is impossible to reconstruct the block that has originated an hash string.

The Linux system you can use of the following applications to generate an hash string:
• md5sum
• sha1sum
• md5, sha1 and sha256 deep
• dhash

**Md5sum**

The MD5 (Message Digest algorithm 5) algorithm is a cryptographic hash algorithm designed by Ronald Rivest in 1991 and standardized with the Request for Comments RFC 1321. MD5 processes a variable-length string into a fixed-length output of 128 bits (known as "MD5 Checksum" or "MD5 Hash") that can be used to compute the digital signature of the input. The process is very fast and it is highly unlikely to get a collision between the output of two different input strings. Moreover, as with most hashing algorithms, it shouldn't be possible, if not for attempts (brute force) to be traced back to the input string starting from the output string (the range of possible values in output is in fact equal to $2^{128}$). Example:

```
md5sum / dev / sda
```

**Sha1sum**

The Secure Hash Algorithm (SHA) is one of a number of cryptographic hash functions designed in 1993 by the National Security Agency (NSA) and published by NIST as a U.S. Federal Information Processing Standard. Like any hash algorithm, the SHA produces a fixed-length message digest, or fingerprint of the message, from a message of a variable length. The security of a hash algorithm is that the function is not reversible (ie you can not trace back the original message knowing only its hash information) and it should not be possible to create "collisions" between hash: it's not possible obtain the same hash digest starting from different files. This family of algorithms is referred as SHA-1, SHA-224, SHA-256, SHA-384 and SHA-512. The last four varieties often referred to generically as SHA-2, in order to distinguish them from previous versions. The first type produces a message digest of 160
bits only, while others produce digests of length equal to the number indicated in their letters (i.e. SHA-256 produces a digest of 256 bits).

Currently, the SHA-1 algorithm is the most common of the SHA family and it’s used in many applications and protocols.

Example:

\[sha1sum \ dev \ sda\]

**MD5 and SHA deep**

Md5, sha1, sha256 and sha512 allow you it to calculate hashes of multiple files

Example:

\[md5deep\ -l \ root \ evidence > hash_device.txt\]

The syntax mentioned above calculates the md5 hash of all files in /root/evidence/ directory and saves them in the hash_device.txt file.

**Dhash**

Dhash, (Italian and English versions are available), allows (in addition to the simultaneous acquisition and calculation of the hash) to calculate only the hash of file and storage system providing real time information during the calculation as the estimated time before the end of the operation and the status of the calculation, the term can also generate a report in html format.

From inhouse tests we determinated that Dhash is 10% faster than the other tools listed above.

Example:

\[dhash-t-f \ dev \ sda - md5 - sha1\ - l \ dhashlog.html\]

The syntax above mentioned simultaneously allow you to calculate the sha1 and md5 hash of the /dev/sda device and save the values in the dhashlog.html file.

The program is available in Italian and English.

**Capture Storage Media**

the process of acquiring a mass storage allows cloning of a real memory location of activity. Inside the Linux system this is possible through the use of the following tools:

- **dd**
- **ddrescue**
dd

Dd takes as input a file or device and replicates its exact binary sequence on another device of file.

Example:

```
dd if = / dev / sda of = / media / disco.img
```

The command takes as input the mass memory b / dev / sda and returns as output in his clone disco.img file in the / media / folder.

you can use it to clone a memory device not only from a mass storage file (or vice versa) and also from mass storage to mass storage.

Example:

```
dd if = / dev / sda of = / dev / sdb
```

ddrescue

Like dd, ddrescue can clone the memory contents of a disk directly to another memory support.

ddrescue is an evolution of dd: unlike dd it will continue reading the following sector, if it finds bad sectors it cannot read. Those bad sectors will be acquired by setting to zero all the unreadable bits. During the acquisition process ddrescue provided updates on how many read and written bytes, how many errors have been found and the capture rate calculated for bytes / s.

Example:

```
ddrescue / dev / sda / media / disco.img
```

dcfldd

dcfldd is an enhanced version of other dd tools and it can be used to calculate hash (md5 or sha1 that, individually or together) during the acquisition of memory. During the
acquisitions process it also will provide details on how much data has been have read and written.

Example:

```
dcfldd if=/dev/sda of=/media/disco.img hash=sha1 hash=md5
```

**Dhash**

This software allows you to acquire in the dd format and, in the same time, the hash calculation. It's is 10% faster than other tools available.

**Example:**

```
dhash-t-f /dev/sda -md5 -sha1-o disco.dd
```

The aforementioned syntax allow you to capture and simultaneously calculate the sha1 and md5 hash of the /dev/sda device and save the result in the dhashlog.html log file.
Creating a time line

One of the most popular tools for creating time line is *mac-time*, part of the Sleuth kit suite created and maintained by Brian Carrier. *Mac-time* can creates an ASCII timeline of file activity based on the output of the *fls* tool that consist on a list of the files and directory names of a file system. *fls* is able to process the contents of a given file system or directory and and returns a list of all files, allocated/not allocated, that can be used later in *mac-time* tool.

**FLS**

The following example show how to use *fls* and *mac-time* tools.

```bash
fls -z GMT -s 0 -m `c: -f ntfs -r / caso1/image-1.dd` > / caso1/list-image1
```

the -z option specify the time zone, -s the difference, in seconds, between the system time and the the real time, -m show the beginning of each path of each file and folder path,-f indicates the type of file system that will be analized, / caso1/image-1.dd is the image that is given as input and and / caso1/list-image1 the file that will contain the list of the files.

```bash
mactime -b / z-caso1/list-image gmt-d> / caso1/timeline.csv
```

the -b option indicates the file to analyze, -z the timezone and -d> / caso1/timeline.csv indicate the name of the time line in the csv format.

The following table is useful to understand the meaning of the values that appear in the column "Activity Type". They indicate the action performed on files and folders in a given period of time.

<table>
<thead>
<tr>
<th>File system:</th>
<th>M=</th>
<th>A</th>
<th>C</th>
<th>B (ITA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ext2 / 3</td>
<td>Changed</td>
<td>Accessed</td>
<td>Created</td>
<td>n / a</td>
</tr>
<tr>
<td>FAT</td>
<td>Writing</td>
<td>Accessed</td>
<td>n / a</td>
<td>Created</td>
</tr>
<tr>
<td>NTFS</td>
<td>Changed</td>
<td>Accessed</td>
<td>MFT(^4) modified</td>
<td>Created</td>
</tr>
</tbody>
</table>

\(^1\) It is preferable to export in csv format for easier reference work by applications like OpenOffice or Excel.

\(^4\) Master File Table
Search for files and directory

It's possible to search for files and directory using one of the following tools:

- `locate`
- `find`

**Locate**

The Locate tool allows you to search for files in a mass storage. But in the first place you must index all the file using the `updatedb` command. This command

```
locate finance -q -i
```

The `-i` option allows you to run a search for files that contain the word finance without considering capitalization. The `-q` option will report access errors to specific system directories and will indicate the reasons (e.g., "access denied").

**Example:**

```
locate "*.png" -q
```

It will search for all the png file.

**Find**

Find allows you to search for files without a prior indexing.

**Example:**

```
find /wholename -"* porn * .png"
```

The tool will find all PNG files which contain the string name in porn without discrimination case.

**Example:**

```
find -ctime -2 > lista.txt
```

The tool will find all files created in the last 2 days and it will save the list in the `lista.txt` file.

**File Carving**
The carving process is the practice to search files based on its content, through the recognition of header and footer, rather its metadata. It’s quite a long process because the disk is analyzed from first to the last bit. metaphorically speaking, we can compare the reading process of the mass memory to the process of reading a tape drive.

**Foremost**

The Foremost program can recover deleted files directly from the storage devices, or preferably, from the "bit stream image" files. The command

```
foremost-o outpdir dump.img
```

will start the carving process on `dump.img` file based on the `/etc/foremost.conf` configuration set and save the extracted files in the `outpdir` directory.

The command

```
foremost-t jpeg-o outpdir dump.img
```

will run the carving process of all the `png` files on the `dump.img` file and save the extracted files in the `outpdir` folder.

The `-t` option will allow the user to retrieve the following types of files:

- `jpg`
- `gif`
- `png`
- `bmp`
- `avi`
- `exe`
- `mpg`
- `Wave`
- ` riff`
- `wmv`
- `mov`
- `PDF`
- `ole`
- `doc`
- `zip`
- `rar`
- `htm`
- `cpp`

Header and footer are signatures that characterize the beginning and end of any given file type: they are a group of consecutive hexadecimal or octal values always present in a certain position at the beginning or the end of the file.
DEFT Linux GUI

Introduction

The DEFT Linux GUI is based on the LXDE “desktop environment” (Lightweight X11 Desktop Environment). We choose the LXDE desktop manager for its features and because it is one of the lightest Linux graphical interfaces.

You have to run to the DEFT Linux graphical mode if you need to use programs like Digital Forensic Framework (FDF) or Catfish.

Since version 6, Microsoft Windows native applications, without any equivalent in the Linux world, have been integrated directly in the DEFT system using Wine.

To start the GUI DEFT Linux simply type the `deft-gui`.

---

6 http://www.lxde.org
7 http://www.winehq.org/
On the desktop you can find the following elements:

1. Application Menu
2. File manager
3. Mount manager
4. Program for taking screenshots
5. Show the desktop
6. Audio Management
7. Network Management
8. System time
9. Manager to suspend, log out, restart and shutdown
10. Autopsy evidence and directories used by other applications to save files of interest statements submitted to analysis
11. Utility to configure the system time references
12. Console

More specifically, in the Applications menu you can find:

**Accessories:** File manager, Calculator, Image viewer, LXTerminal, Manage print jobs, Xarchiver.

**Disk Forensics:** Autopsy, Catfish, Chrome Cache View, DFF, Dhash 2, Disk Utility, Guymager, Hb4most, Hex editor, view IE cache, IE cookies view, view IE history, index.dat analyzer, Mountanager, Mozilla Cache View, Mozilla history view, Opera cache view, Ophcrack, Scite text editor, Skype log view, Take screenshot, Virus scanner, WRR, Xnview.

**Forensic Network:** Firefox, Wireshark, Xplico.

**Sound & Video:** Desktop recorder, Xfburn.

**System Tools:** htop, System Profiler, Task manager.

**Preferences:** Additional drivers, look Customize, Desktop session setting, Disk Utility, Keyboard and mouse, language support, monitor settings, Openbox configuration,
Preferred Applications, Printing, Synaptic Package Manager, Time and date, user and groups, Windows wireless drivers.

**Mass Storage Management**

The managing storage devices policies in Linux DEFT gui mode are almost identical to the command line version.

In detail:

- By default, the system does not perform any action but the detection of devices connected to the system.
- if you use the file manager, all storage devices, internal and external, will be mounted in RW (read write) mode.
- The Mount Manager application allows the operator to customize the device mount policies.

*Mount in RW mode using lxde file manager*
Mount manager

Mount Manager allows you to translate clicks to advanced mount policies. The following procedure show how to mount a mass memory in RO (read only) mode avoid any action that would alter the file system.

In detail, to mount a device you need to associate an existing directory to a partition of the memory and ensure that you have configured the noatime, noauto, ro, noexec parameters to avoid memory alteration of the mass storage during use. Only in this way you can access the file system in read-only mode and work without updating the access time inode\(^8\).

Mount Manager also allow you to mount acquisitions in the format .DD and network filesystems such as Samba (Windows shares) and NFS.

**Hash calculation**

Dhash is the only Linux DEFT graphic tool for hashing.

---

\(^8\) Timestamp of last access to a file system's file
Calculation of the hash of a device by Dhash

Once you the program starts, click "open device" to select a storage device or "open file" to select a file, check to calculate the hash (md5, sha1 or both) and click on "starts". Once you are finished you can save a html report containing the results by clicking on "save log".

Acquisition of mass storage

As already indicated, DEFT Linux can acquire mass storage devices, via a graphical interface, using Dhash or Guymager. The first one is suitable for acquisitions in the DD format, while the second one is strongly recommended for parallel acquisition and in the ewf format.

Dhash

In Dhash, the procedure for the acquisition is similar to the hash calculation. Select the device that you want to acquire by clicking on "open device" and selecting "Acquire".

You can capture and compress your target in the gz format by checking the box "Compress" and / or perform the hash check.
Acquisition of mass memory with a parallel md5 sha1 hash contemporary calculation

by pressing the "Starts" starts the acquisition.

At the end of the task, you can save a report in the html format by clicking the "Save log".

**Guymager**

Unlike Dhash, Guymager allows a more advanced acquisition procedure.

*Guymager’s acquisition phase: the Case management window*

Guymager allows you the simultaneous acquisition of multiple mass storage devices and the management of informations as:

- Case number.
- Evidence number.
- Examiner's name.
- Description of the device you are capturing.
Guymager supports all major formats of acquisition (dd, encase and aff) and allow to perform the integrity check, through verification of md5 or sha256, of both the image and the original device.

To start the acquisition process, launch the program, right click on the mass memory that you want to clone and select "Acquire image". The window "Acquire Image" allows you to set several options of the acquisition and the management phases of the case.
Search for files and folders

Catfish allow you to perform the same tasks you can do by "command line" using **find** and **locate**.

In this example, once selected the path, we launch a search for TXT files by typing in the search field: `*.txt`. When the search is complete, you can open the files in the list with a simple double click.

In the window will be indicated even more information on the files: last modification date, file location and size.

File Carving

4most hunchbacked, available in Italian and English language, is a graphical interface for managing the main feature of foremost. With H4M you can carve for files with a few clicks.
H4M, once selected files or devices to search and the folder to save recovered files, search for and save all files with the header and footer set by the operator. In addition to traditional file formats supported by Foremost, you can customize your search by indicating the path of the configuration file containing the new headers and footers.

**Case Management with Autopsy**

The Autopsy Forensic Browser is a graphical interface to the command line digital investigation tools in The Sleuth Kit\(^9\). It is mainly used for handling cases requiring the analysis of mass storage. Autopsy allows you to:

- directly use the device or acquisitions in the format dd, aff and encase;
- View file system’s information;
- Analyze and identify the contents of files and directories and their time references;
- Recover deleted files;
- Manage a hash file database regarding the the case;

\(^9\) [http://www.sleuthkit.org/](http://www.sleuthkit.org/)
Create and parse the timeline;
- Searches for files by keyword;
- Analyze meta data;
- Create reports of the found evidences.

**Creating a new case**

Click on the the Autopsy icon in the Forensic Disk folder (start menu). The program will request to create a new case or open an existing one.

In this example we will click on “new” to create our test case and fill all the data field, i.e. the case name, description of the case and the investigator names:

![Creating new case](image)

Once you confirmed all the inserted data details, you will be able to create a "case" directory containing all the details in the path /root/evidence/case.

You can add one or more objects (or actors portraying members or computer systems) by clicking on "add host" in the case and enter the required data:
To every host you can be add one or more disk image. Just click on “Add Image File” and fill the “location” box with the direct connection to a storage device (like /dev/sdx) or the path of the file containing the acquisition (such as /media/forensic/disco001.dd). You must specify whether the memory you’re adding is a partition or the entire mass storage. Regarding the import method, for ease of use, it is strongly advised to leave the default import method, (symlink).
after you added memory's image, Autopsy will ask to check the data integrity calculating the MD5 hash or if you already did it, to manually import the value of the hash md5\textsuperscript{10}. Autopsy will request to file the mount point of the partition and its file system type.

\textit{Managing host's details}

After you finish all the previous operations, the creation of Disco001 object is complete and you can continue and add more images or object or you can start the analysis by clicking on "Analyze" button.

\textsuperscript{10} Autopsy supports only the MD5 hash algorithm.
Managing the "Disco001" host

The analysis module interface allows you to view the partition's directory tree under analysis. When you select a file, it will display a preview of the content.

The access to the files is read-only mode to not alter their references to time and its metadata.

In the analysis screen you can see:

- The file name/directory and its path
- The time values as Created Time, Changed Time/Written Time and Modified Time
- The File/directory type
- not allocated (bright red) or not accurately referenced (darker red) file/directory or (.
An interesting feature is the keyword search. This feature allows you to search using the `grep` command and covers the entire file system tree, including the unallocated space. This operation may be very slow when you search strings on disks/images containing many files or large amount memory. In these cases we suggest you to open a system shell and perform your search using the `grep` command line.

The same recommendation applies to the creation of timeline reports.
**Xplico**

DEFT has always supported the Xplico project's evolution since the earliest releases\(^\text{11}\). Xplico is very easy to use: if a pcap file is given as input\(^\text{12}\), the program is able to reconstruct the contents of all the data sent in that moment in the IP network and making them available and accessible through a friendly web interface.

![Xplico Login](image)

**Creating a new case**

You can run Xplico from the Forensic Section of the Network menu in the start menu and using the following credentials to gain access to the operator if:

- user: xplico
- password: xplico

These are the default user credentials. With them you can create and manage the cases but you can’t change any settings.

If you want to customize the control panel settings, create new users, etc., you must login with administrator credentials:

- user: admin
- password: xplico

---

\(^{11}\) The tool, available at this address [http://www.xplico.org/](http://www.xplico.org/), is right now one of the most powerful open source Network Forensic Tool.

\(^{12}\) This file contains data packets captured by a “packet sniffing” program. Usually they are packages that were registered while transmitted over a network.
In the following example, we created a new case ("Pippo") and we acquired and analyzed all traffic transmitted by the interface eth0 of our workstation in that moment in that specific range of time.

At the end of acquisition phase, Xplico have already decode and reconstruct all supported data type, as:

- HTTP
- IMAP
- rtp
- DNS
- sip
- PJL
- web mail
- Telnet -
- facebook chat
- smtp
- ftp
- MSN
- POP3
- tftp
- irc
In the previous example, we visited the "http://www.libero.it" site requested by the user. From the section "site" of the "web" menu you can access to The list of all the reconstructed Web sites and all the other transmitted data. 

you should consider that the list of all get[^13] also include those that the user involuntary performs: i.e. all requests from the web page to the different kind of advertising service or tracking scripts.

[^13]: request to a web server to display a specific url
DEFT Extra

DEFT Extra is a graphical interface for Microsoft Windows OS family. It's based on the pre-installed .NET Framework, which allows the execution of several digital forensic programs (and their descriptions and potential uses) during the triage and the pre-analysis of a suspect computer system. Every time you run the GUI, it will ask you where to save the activities report (a txt file). If you cancel this request, DEFT Extra will not keep track of any operation carried out.

DEFT Extra, and all its tools MAY alter the system under test:

- Windows registry keys will store the launch of DEFT Extra autorun (if enabled);
- Last accessed timestamp of analyzed files;
- Running DEFT-Extra-3.0.exe process;
- If the user decides to save the report within the mass storage system (and not on an external support) part of the free space of the unallocated data will be overwritten.

For more details on each tool, please refer to the guides written by their respective developers.
APPENDICE 1 – parametri per il boot del Kernel

Kernel Parameters

The following is a consolidated list of the kernel parameters as implemented
(mostly) by the __setup() macro and sorted into English Dictionary order
(defined as ignoring all punctuation and sorting digits before letters in a
case insensitive manner), and with descriptions where known.

Module parameters for loadable modules are specified only as the
parameter name with optional '=' and value as appropriate, such as:

    modprobe USBcore blinkenlights=1

Module parameters for modules that are built into the kernel image
are specified on the kernel command line with the module name plus
'.' plus parameter name, with '=' and value if appropriate, such as:

    USBcore.blinkenlights=1

Hyphens (dashes) and underscores are equivalent in parameter names, so

    log_buf_len=1M print-fatal-signal=1

can also be entered as

    log-buf-len=1M print_fatal_signals=1

This document may not be entirely up to date and comprehensive. The
command

    "modinfo -p $\{modulename\}"

shows a current list of all parameters of a
loadable
module. Loadable modules, after being loaded into the running kernel, also
reveal their parameters in /sys/module/$\{modulename\}/parameters/. Some of
these
parameters may be changed at runtime by the command

    "echo -n $\{value\} > /sys/module/$\{modulename\}/parameters/$\{parm\}".

The parameters listed below are only valid if certain kernel build options
were
enabled and if respective hardware is present. The text in square brackets at
the beginning of each description states the restrictions within which a
parameter is applicable:

    ACPI   ACPI support is enabled.
    AGP   AGP (Accelerated Graphics Port) is enabled.
    ALSA   ALSA sound support is enabled.
APIC  APIC support is enabled.
APM  Advanced Power Management support is enabled.
AVR32  AVR32 architecture is enabled.
AX25  Appropriate AX.25 support is enabled.
BLACKFIN Blackfin architecture is enabled.
DRM  Direct Rendering Management support is enabled.
EDD  BIOS Enhanced Disk Drive Services (EDD) is enabled
EFI  EFI Partitioning (GPT) is enabled
EIDE  EIDE/ATAPI support is enabled.
FB  The frame buffer device is enabled.
GCOV  GCOV profiling is enabled.
HW  Appropriate hardware is enabled.
IA-64  IA-64 architecture is enabled.
IMA  Integrity measurement architecture is enabled.
IOSCHED  More than one I/O scheduler is enabled.
IP_PNP  IP DHCP, BOOTP, or RARP is enabled.
IPV6  IPv6 support is enabled.
ISAPNP  ISA PnP code is enabled.
ISDN  Appropriate ISDN support is enabled.
JOY  Appropriate joystick support is enabled.
KGDB  Kernel debugger support is enabled.
KVM  Kernel Virtual Machine support is enabled.
LIBATA  Libata driver is enabled
LP  Printer support is enabled.
LOOP  Loopback device support is enabled.
M68k  M68k architecture is enabled.
These options have more detailed description inside of
Documentation/m68k/kernel-options.txt.
MCA  MCA bus support is enabled.
MDA  MDA console support is enabled.
MOUSE  Appropriate mouse support is enabled.
MSI  Message Signaled Interrupts (PCI).
MTD  MTD (Memory Technology Device) support is enabled.
NET  Appropriate network support is enabled.
NUMA  NUMA support is enabled.
GENERIC_TIME  The generic timeofday code is enabled.
NFS  Appropriate NFS support is enabled.
OSS  OSS sound support is enabled.
PV_OPS  A paravirtualized kernel is enabled.
PARIDE  The ParIDE (parallel port IDE) subsystem is enabled.
PARISC  The PA-RISC architecture is enabled.
PCI  PCI bus support is enabled.
PCIE  PCI Express support is enabled.
PCMCIA  The PCMCIA subsystem is enabled.
PNP  Plug & Play support is enabled.
PPC  PowerPC architecture is enabled.
PPT  Parallel port support is enabled.
PS2  Appropriate PS/2 support is enabled.
RAM disk support is enabled.
S390 architecture is enabled.
SCSI Appropriate SCSI support is enabled.
A lot of drivers has their options described inside of
Documentation/scsi/
SECURITY Different security models are enabled.
SELINUX SELinux support is enabled.
SERIAL Serial support is enabled.
SH SuperH architecture is enabled.
SMP The kernel is an SMP kernel.
SPARC Sparc architecture is enabled.
SWSUSP Software suspend (hibernation) is enabled.
SUSPEND System suspend states are enabled.
FTRACE Function tracing enabled.
TPM TPM drivers are enabled.
TS Appropriate touchscreen support is enabled.
UMS USB Mass Storage support is enabled.
USB USB support is enabled.
USBHID USB Human Interface Device support is enabled.
V4L Video For Linux support is enabled.
VGA The VGA console has been enabled.
VT Virtual terminal support is enabled.
WDT Watchdog support is enabled.
XT IBM PC/XT MFM hard disk support is enabled.
X86-32 X86-32, aka i386 architecture is enabled.
X86-64 X86-64 architecture is enabled.
More X86-64 boot options can be found in
Documentation/x86/x86_64/boot-options.txt .
X86 Either 32bit or 64bit x86 (same as X86-32+X86-64)

In addition, the following text indicates that the option:
BUGS= Relates to possible processor bugs on the said processor.
KNL Is a kernel start-up parameter.
BOOT Is a boot loader parameter.

Parameters denoted with BOOT are actually interpreted by the boot
loader, and have no meaning to the kernel directly.
Do not modify the syntax of boot loader parameters without extreme
need or coordination with <Documentation/x86/boot.txt>.
There are also arch-specific kernel-parameters not documented here.
See for example <Documentation/x86/x86_64/boot-options.txt>.
Note that ALL kernel parameters listed below are CASE SENSITIVE, and that
a trailing = on the name of any parameter states that that parameter will
be entered as an environment variable, whereas its absence indicates that
it will appear as a kernel argument readable via /proc/cmdline by programs
running once the system is up.

The number of kernel parameters is not limited, but the length of the
complete command line (parameters including spaces etc.) is limited to
a fixed number of characters. This limit depends on the architecture
and is between 256 and 4096 characters. It is defined in the file
/include/asm/setup.h as COMMAND_LINE_SIZE.

```
acpi=
    [HW,ACPI,X86]
    Advanced Configuration and Power Interface
    Format: { force | off | strict | noirq | rsdt }
    force -- enable ACPI if default was off
    off -- disable ACPI if default was on
    noirq -- do not use ACPI for IRQ routing
    strict -- Be less tolerant of platforms that are not
    strictly ACPI specification compliant.
    rsdt -- prefer RSDT over (default) XSDT
    copy_dsdt -- copy DSDT to memory

See also Documentation/power/pm.txt, pci=noacpi
```

```
acpi_apic_instance= [ACPI, IOAPIC]
    Format: <int>
    2: use 2nd APIC table, if available
    1,0: use 1st APIC table
    default: 0
```

```
acpi_backlight= [HW,ACPI]
    acpi_backlight=vendor
    acpi_backlight=video
    If set to vendor, prefer vendor specific driver
    (e.g. thinkpad_acpi, sony_acpi, etc.) instead
    of the ACPI video.ko driver.
```

```
acpi.debug_layer= [HW,ACPI,ACPI_DEBUG]
acpi.debug_level= [HW,ACPI,ACPI_DEBUG]
    Format: <int>
    CONFIG_ACPI_DEBUG must be enabled to produce
    any ACPI debug output. Bits in debug_layer correspond to a
    _COMPONENT in an ACPI source file, e.g.,
    #define _COMPONENT

ACPI_PCI_COMPONENT
```

```
Bits in debug_level correspond to a level in
ACPI_DEBUG_PRINT statements, e.g.,
ACPI_DEBUG_PRINT((ACPI_DB_INFO,...
The debug_level mask defaults to "info". See
Documentation/acpi/debug.txt for more information
about
ddebug layers and levels.

Enable processor driver info messages:
acpi.debug_layer=0x20000000
Enable PCI/PCI interrupt routing info messages:
acpi.debug_layer=0x400000
Enable AML "Debug" output, i.e., stores to the Debug
object while interpreting AML:
acpi.debug_layer=0xffffffff acpi.debug_level=0x2
Enable all messages related to ACPI hardware:
acpi.debug_layer=0x2 acpi.debug_level=0xffffffff

Some values produce so much output that the system is
unreadable. The "log_buf_len" parameter may be useful
if you need to capture more output.

acpi_display_output= [HW,ACPI]
acpi_display_output=vendor
acpi_display_output=video
See above.

acpi_irq_balance [HW,ACPI]
ACPI will balance active IRQs
default in APIC mode

acpi_irq_nobalance [HW,ACPI]
ACPI will not move active IRQs (default)
default in PIC mode

acpi_irq_isa= [HW,ACPI] If irq_balance, mark listed IQs used by
ISA
Format: <irq>,<irq>...

acpi_irq_pci= [HW,ACPI] If irq_balance, clear listed IRQs for
use by PCI
Format: <irq>,<irq>...

acpi_no_auto_ssd = [HW,ACPI] Disable automatic loading of
SSDT

acpi_os_name= [HW,ACPI] Tell ACPI BIOS the name of the
OS
Format: To spoof as Windows 98: ="Microsoft
Windows"
acpi_osi= [HW,ACPI] Modify list of supported OS interface strings
acpi_osi="string1"  # add string1 -- only one string
acpi_osi="!string2"  # remove built-in string2
acpi_osi=             # disable all strings

acpi_pm_good[X86]
Override the pmtimer bug detection: force the kernel to assume that this machine's pmtimer latches its value and always returns good values.

acpi_sci= [HW,ACPI] ACPI System Control Interrupt trigger mode
Format: { level | edge | high | low }

acpi_serialize [HW,ACPI] force serialization of AML methods

acpi_skip_timer_override [HW,ACPI]
Recognize and ignore IRQ0/pin2 Interrupt Override. For broken nForce2 BIOS resulting in XT-PIC timer.

acpi_sleep= [HW,ACPI] Sleep options
Format: { s3_bios, s3_mode, s3_bEEP, s4_nohwsig,
         old_ordering, s4_nonvs, sci_force_enable }
See Documentation/power/video.txt for information on s3_bios and s3_mode.
s3_bEEP is for debugging; it makes the PC's speaker beep as soon as the kernel's real-mode entry point is called.
s4_nohwsig prevents ACPI hardware signature from being used during resume from hibernation.
old_ordering causes the ACPI 1.0 ordering of the _PTS control method, with respect to putting devices into low power states, to be enforced (the ACPI 2.0 ordering of _PTS is used by default).
nonvs prevents the kernel from saving/restoring the ACPI NVS memory during suspend/hibernation and resume.
sci_force_enable causes the kernel to set SCI_EN spec, directly on resume from S1/S3 (which is against the ACPI but some broken systems don't work without it).

acpi_use_timer_override [HW,ACPI]
Use timer override. For some broken Nvidia NF5 boards that require a timer override, but don't have HPET

acpi_enforce_resources= [ACPI]

Check for resource conflicts between native drivers and ACPI OperationRegions (SystemIO and SystemMemory only). IO ports and memory declared in ACPI might be used by the ACPI subsystem in arbitrary AML code and can interfere with legacy drivers.

strict (default): access to resources claimed by ACPI is denied; legacy drivers trying to access reserved resources will fail to bind to device using them.
lax: access to resources claimed by ACPI is allowed; legacy drivers trying to access reserved resources will bind successfully but a warning message is logged.
no: ACPI OperationRegions are not marked as reserved, no further checks are performed.

ad1848= [HW,OSS] Format: <io>,<irq>,<dma>,<dma2>,<type>

add_efi_memmap [EFI; X86] Include EFI memory map in kernel's map of available physical RAM.

advansys= [HW,SCSI]
See header of drivers/scsi/advansys.c.

aedsp16= [HW,OSS] Audio Excel DSP 16
Format:
<io>,<irq>,<dma>,<mss_io>,<mpu_io>,<mpu_irq>

See also header of sound/oss/aedsp16.c.

agp= [AGP]

off | try_unsupported }
off: disable AGP support
try_unsupported: try to drive unsupported chipsets (may crash computer or cause data corruption)

aha152x= [HW,SCSI]
See Documentation/scsi/aha152x.txt.

aha1542= [HW,SCSI]
Format:
<portbase>[,<buson>,<busoff>][,<dmaspeed>]]

aic7xxx= [HW,SCSI] See Documentation/scsi/aic7xxx.txt.

alignment= [KNL,ARM]
Allow the default userspace alignment fault handler
behaviour to be specified. Bit 0 enables warnings,
business fixups, and bit 2 sends a segfault.

amd_iommu= [HW,X86-64]
Pass parameters to the AMD IOMMU driver in the
system.

Possible values are:
fullflush - enable flushing of IO/TLB entries when
they are unmapped. Otherwise they are
flushed before they will be reused, which
is a lot of faster
off  - do not initialize any AMD IOMMU found in
the system

amijoy.map= [HW,JOY] Amiga joystick support
Map of devices attached to JOY0DAT and JOY1DAT
Format: <a>,<b>
See also Documentation/kernel/input/joystick.txt

analog.map= [HW,JOY] Analog joystick and gamepad support
Specifies type or capabilities of an analog joystick
connected to one of 16 gameports
Format: <type1>,<type2>,<type16>

apc= [HW,SPARC]
Power management functions (SPARCstation-4/5 +
deriv.)
Format: noidle
Disable APC CPU standby support. SPARCstation-
not play well with APC CPU idle - disable it if you
have

apic= [APIC,X86-32] Advanced Programmable Interrupt
Controller
Change the output verbosity whilst booting
autoconf= [IPV6]  
See Documentation/networking/ipv6.txt.

show_lapic= [APIC,X86] Advanced Programmable Interrupt Controller  
Limit apic dumping. The parameter defines the maximal number of local apics being dumped. Also it is possible to set it to "all" by meaning -- no limit here.

Format: { 1 (default) | 2 | ... | all }.
The parameter valid only apic=debug or apic=verbose is specified.
Example: apic=debug show_lapic=all

apm= [APM] Advanced Power Management
See header of arch/x86/kernel/apm_32.c.

arcrimi= [HW,NET] ARCnet - "RIM I" (entirely mem-mapped) cards

ataflop= [HW,M68k]
atarimouse= [HW,MOUSE] Atari Mouse
atascsi= [HW,SCSI] Atari SCSI
atkbdd.extra= [HW] Enable extra LEDs and keys on IBM RapidAccess, EzKey and similar keyboards

atakbdd.reset= [HW] Reset keyboard during initialization
atkbdd.set= [HW] Select keyboard code set
Format: <int> (2 = AT (default), 3 = PS/2)
atkbdd.scroll= [HW] Enable scroll wheel on MS Office and similar keyboards
atkbdd.softraw= [HW] Choose between synthetic and real raw mode
Format: <bool> (0 = real, 1 = synthetic (default))
atkbdd.softrepeat= [HW]
Use software keyboard repeat

```
autotest [IA64]
```

```
baycom_epp= [HW,AX25]
Format: <io>,<mode>
```

```
baycom_par= [HW,AX25] BayCom Parallel Port AX.25 Modem
Format: <io>,<mode>
See header of drivers/net/hamradio/baycom_par.c.
```

```
baycom_ser_fdx= [HW,AX25] BayCom Serial Port AX.25 Modem (Full Duplex Mode)
Format: <io>,<irq>,<mode>[,<baud>]
See header of drivers/net/hamradio/baycom_ser_fdx.c.
```

```
baycom_ser_hdx= [HW,AX25] BayCom Serial Port AX.25 Modem (Half Duplex Mode)
Format: <io>,<irq>,<mode>
See header of drivers/net/hamradio/baycom_ser_hdx.c.
```

```
boot_delay= Milliseconds to delay each printk during boot.
Values larger than 10 seconds (10000) are changed to no delay (0).
```

```
bootmem_debug [KNL] Enable bootmem allocator debug messages.
```

```
bttv.card= [HW,V4L] bttv (bt848 + bt878 based grabber cards)
bttv.radio= Most important insmod options are available as kernel args too.
bttv_pll= See Documentation/video4linux/bttv/Insmod-options
bttv.tuner= and Documentation/video4linux/bttv/CARDLIST
```

```
BusLogic= [HW,SCSI]
See drivers/scsi/BusLogic.c, comment before function BusLogic_ParseDriverOptions().
```

```
c101= [NET] Moxa C101 synchronous serial card
cachesize= [BUGS=X86-32] Override level 2 CPU cache size detection.
Sometimes CPU hardware bugs make them report the cache size incorrectly. The kernel will attempt work arounds
to fix known problems, but for some CPUs it is not possible to determine what the correct size should be. This option provides an override for these situations.

capability.disable=

[SECURITY] Disable capabilities. This would normally be used only if an alternative security model is to be configured. Potentially dangerous and should only be used if you are entirely sure of the consequences.

ccw_timeout_log [S390]
See Documentation/s390/CommonIO for details.

cgroup_disable= [KNL] Disable a particular controller
Format: \{ name of the controller(s) to disable \}
\{Currently supported controllers - "memory"\}

clockreqprot [SELINUX] Set initial clockreqprot flag value.
Format: \{ "0" | "1" \}
See security/selinux/Kconfig help text.
0 -- check protection applied by kernel (includes any implied execute protection).
1 -- check protection requested by application.
Default value is set via a kernel config option. Value can be changed at runtime via /selinux/checkreqprot.

cio_ignore= [S390]
See Documentation/s390/CommonIO for details.

clock= [BUGS=X86-32, HW] gettimeofday clocksource override.

[Deprecated]
Forces specified clocksource (if available) to be used when calculating gettimeofday(). If specified clocksource is not available, it defaults to PIT.
Format: \{ pit | tsc | cyclone | pmtmr \}

clocksource= [GENERIC_TIME] Override the default clocksource
Format: <string>
Override the default clocksource and use the clocksource with the name specified.
Some clocksource names to choose from, depending on the platform:
[all] jiffies (this is the base, fallback clocksource)
[ACPI] acpi_pm
[ARM] imx_timer1,OSTS,netx_timer,mpu_timer2,
      pxa_timer,timer3,32k_counter,timer0_1
[AVR32] avr32
[X86-32] pit,hpet,tsc,vmi-timer;
scx200_hrt on Geode; cyclone on IBM x440
[MIPS] MIPS
[PARISC] cr16
[S390] tod
[SH] SuperH
[SPARC64] tick
[X86-64] hpet,tsc
clearcuid=BITNUM [X86]
Disable CPUID feature X for the kernel. See
arch/x86/include/asm/cpufeature.h for the valid bit
numbers. Note the Linux specific bits are not
necessarily
stable over kernel options, but the vendor specific
ones should be.
Also note that user programs calling CPUID directly
or using the feature without checking anything
will still see it. This just prevents it from
being used by the kernel or shown in /proc/cpuinfo.
Also note the kernel might malfunction if you disable
some critical bits.
cmo_free_hint= [PPC] Format: { yes | no }
Specify whether pages are marked as being inactive
when they are freed. This is used in CMO
environments to determine OS memory pressure for page stealing by
a hypervisor.
Default: yes
code_bytes [X86] How many bytes of object code to print
in an oops report.
Range: 0 - 8192
Default: 64
com20020= [HW,NET] ARCnet - COM20020 chipset
Format:
<io>[,<irq>[,<nodeID>[,<backplane>[,<ckp>[,<timeout>]]]]]
com90io= [HW,NET] ARCnet - COM90xx chipset (IO-mapped
buffers)
Format: <io>[,<irq>]
com90xx= [HW,NET] ARCnet - COM90xx chipset (memory-mapped buffers)
Format: <io>,<irq>,<memstart>]
condev= [HW,S390] console device
conmode=
console= [KNL] Output console device and options.
tty<n> Use the virtual console device <n>.
ttyS<n>[,options]
ttyUSB0[,options]
Use the specified serial port. The options are of
the form "bbbbbppn", where "bbbb" is the baud rate,
"p" is parity ("n", "o", or "e"), "n" is number of
bits, and "f" is flow control ("r" for RTS or
omit it). Default is "9600n8".
See Documentation/serial-console.txt for more
information. See
Documentation/networking/netconsole.txt for an
alternative.

uart[8250],io,<addr>[,options]
uart[8250],mmio,<addr>[,options]
Start an early, polled-mode console on the 8250/16550
UART at the specified I/O port or MMIO address,
switching to the matching ttyS device later. The
options are the same as for ttyS, above.

If the device connected to the port is not a TTY but a braille
device, prepend "brl," before the device type, for instance
console=brl,ttyS0
For now, only VisioBraille is supported.

consoleblank= [KNL] The console blank (screen saver) timeout in
seconds. Defaults to 10*60 = 10mins. A value of 0
disables the blank timer.
coredump_filter= [KNL] Change the default value for
/proc/<pid>/coredump_filter.
See also Documentation/filesystems/proc.txt.
cpcihp_generic= [HW,PCI] Generic port I/O CompactPCI driver
Format:
<first_slot>,<last_slot>,<port>,<enum_bit>[,<debug>

crashkernel=n[KMG]@ss[KMG]
[KNL] Reserve a chunk of physical memory to
hold a kernel to switch to with kexec on panic.

crashkernel=range1:size1[,range2:size2,...][@offset]
[KNL] Same as above, but depends on the memory
in the running system. The syntax of range is
start[-end] where start and end are both
a memory unit (amount[KMG]). See also
Documentation/kdump/kdump.txt for an example.

cs89x0_dma= [HW.NET]
Format: <dma>

cs89x0_media= [HW.NET]
Format: { rj45 | aui | bnc }

dasd= [HW.NET]
See header of drivers/s390/block/dasd_devmap.c.

db9.dev[2|3]= [HW,JOY] Multisystem joystick support via parallel
port
(1 device per port)
Format: <port#>,<type>
See also Documentation/input/joystick-parport.txt

debug [KNL] Enable kernel debugging (events log level).

debug_locks_verbose=
[KNL] verbose self-tests
Format=<01>

Print debugging info while doing the locking API
self-tests.
We default to 0 (no extra messages), setting it to
1 will print _a lot_ more information - normally
only useful to kernel developers.

debug_object [KNL] Enable object debugging

no_debug_objects
[KNL] Disable object debugging

debugpat [X86] Enable PAT debugging

decnet.addr= [HW.NET]
Format: <area>[,<node>]
See also Documentation/networking/decnet.txt.

default_hugepagesz=
    [same as hugepagesz=] The size of the default
    HugeTLB page size. This is the size represented by
    the legacy /proc/ hugepages APIs, used for SHM, and
    default size when mounting hugetlbfs filesystems.
    Defaults to the default architecture's huge page size
    if not specified.

dhash_entries= [KNL]
    Set number of hash buckets for dentry cache.
digi= [HW, SERIAL]
    IO parameters + enable/disable command.
digiepca= [HW, SERIAL]
    See drivers/char/README.epca and
    Documentation/serial/digiepca.txt.
disable= [IPV6]
    See Documentation/networking/ipv6.txt.
disable_ipv6= [IPV6]
    See Documentation/networking/ipv6.txt.
disable_mtrr_cleanup [X86]
    The kernel tries to adjust MTRR layout from
    continuous
    to discrete, to make X server driver able to add WB
    entry later. This parameter disables that.
disable_mtrr_trim [X86, Intel and AMD only]
    By default the kernel will trim any uncacheable
    memory out of your available memory pool based on
    MTRRR settings. This parameter disables that behavior,
    possibly causing your machine to run very slowly.
disable_timer_pin_1 [X86]
    Disable PIN 1 of APIC timer
    Can be useful to work around chipset bugs.
dmasound= [HW, OSS] Sound subsystem buffers
dma_debug=off
    If the kernel is compiled with
    DMA_API_DEBUG support,
    this option disables the debugging code at boot.
dma_debug_entries=<number>
This option allows to tune the number of preallocated
tables for DMA-API debugging code. One entry is
required per DMA-API allocation. Use this if the
DMA-API debugging code disables itself because the
architectural default is too low.

dma_debug_driver=<driver_name>
With this option the DMA-API debugging driver
filter feature can be enabled at boot time. Just
pass the driver to filter for as the parameter.
The filter can be disabled or changed to another
driver later using sysfs.

dsc4.setp= [NET]
dtc3181e= [HW,SCSI]
dynamic printk Enables pr_debug() calls if
CONFIG_DYNAMIC_PRINTK_DEBUG has been
enabled.
These can also be switched on/off via
<debugfs>/dynamic printk/modules

earlycon= [KNL] Output early console device and options.
uart[8250],io,<addr>[:options]
uart[8250],mmio,<addr>[:options]
Start an early, polled-mode console on the 8250/16550
UART at the specified I/O port or MMIO address.
The options are the same as for ttyS, above.

earlyprintk= [X86,SH,BLACKFIN]
earlyprintk=vga
earlyprintk=serial[.ttySn[.baudrate]]
earlyprintk=ttySn[.baudrate]
earlyprintk=dbgp[debugController#]

Append ",keep" to not disable it when the real console
takes over.

Only vga or serial or USB debug port at a time.
Currently only ttyS0 and ttyS1 are supported.
Interaction with the standard serial driver is not
very good.
The VGA output is eventually overwritten by the real console.

`ekgdboc= [X86,KGDB] Allow early kernel console debugging`  
`ekgdboc=kbd`  

This is designed to be used in conjunction with the boot argument: `earlyprintk=vga`

`eata= [HW,SCSI]`  

`edd= [EDD] Format: {"off" | "on" | "skip[mbr]"}`

`esia_irq_edge= [PARISC,HW] See header of drivers/parisc/esa.c.`


`elevator= [IOSCHED] Format: {"anticipatory" | "cfq" | "deadline" | "noop"} See Documentation/block/as-iosched.txt and Documentation/block/deadline-iosched.txt for details.`

`elfcorehdr= [IA64,PPC,SH,X86] Specifies physical address of start of kernel core image elf header. Generally kexec loader will pass this option to capture kernel. See Documentation/kdump/kdump.txt for details.`

`enable_mtrr_cleanup [X86] The kernel tries to adjust MTRR layout from continuous to discrete, to make X server driver able to add WB entry later. This parameter enables that.`

`enable_timer_pin_1 [X86] Enable PIN 1 of APIC timer Can be useful to work around chipset bugs (in particular on some ATI chipsets). The kernel tries to set a reasonable default.`

`enforcing [SELINUX] Set initial enforcing status. Format: {"0" | "1"} See security/selinux/Kconfig help text. 0 -- permissive (log only, no denials).`
1 -- enforcing (deny and log).
Default value is 0.
Value can be changed at runtime via /selinux/enforce.

**eerst_disable** [ACPI]
Disable Error Record Serialization Table (ERST) support.

**ether** [HW.NET] Ethernet cards parameters
This option is obsoleted by the "netdev=" option, which has equivalent usage. See its documentation for details.

**failslab=**
**fail_page_alloc=**
**fail_make_request=[KNL]**
General fault injection mechanism.
Format: <interval>,<probability>,<space>,<times>
See also /Documentation/fault-injection/.

**fd_mcs=** [HW,SCSI]
See header of drivers/scsi/fd_mcs.c.

**fdomain=** [HW,SCSI]
See header of drivers/scsi/fdomain.c.

**floppy=** [HW]
See Documentation/blockdev/floppy.txt.

**force_pal_cache_flush** [IA-64] Avoid check_sal_cache_flush which may hang on buggy SAL_CACHE_FLUSH implementations. Using this parameter will force ia64_sal_cache_flush to call ia64_pal_cache_flush instead of SAL_CACHE_FLUSH.

**ftrace=[tracer]**
[FTRACE] will set and start the specified tracer as early as possible in order to facilitate early boot debugging.

**ftrace_dump_on_oops==orig_cpu**
[FTRACE] will dump the trace buffers on oops.
If no parameter is passed, ftrace will dump buffers of all CPUs, but if you pass orig_cpu, it will dump only the buffer of the CPU that triggered the
oops.

ftrace_filter=[function-list]
[FTRACE] Limit the functions traced by the function tracer at boot up. function-list is a comma separated list of functions. This list can be changed at run time by the set_ftrace_filter file in the debugfs tracing directory.

ftrace_notrace=[function-list]
[FTRACE] Do not trace the functions specified in function-list. This list can be changed at run time by the set_ftrace_notrace file in the debugfs tracing directory.

ftrace_graph_filter=[function-list]
[FTRACE] Limit the top level callers functions traced by the function graph tracer at boot up. function-list is a comma separated list of functions that can be changed at run time by the set_graph_function file in the debugfs tracing directory.

gamecon.map[2][3]=
[HW.JOY] Multisystem joystick and NES/SNES/PSX pad support via parallel port (up to 5 devices per port)

Format: <port#>,<pad1>,<pad2>,<pad3>,<pad4>,<pad5>

See also Documentation/input/joystick-parport.txt

gamma=
[HW.DRM]

gart_fix_e820= [X86_64] disable the fix e820 for K8 GART

Format: off | on
default: on

gcov_persist= [GCOV] When non-zero (default), profiling data for kernel modules is saved and remains accessible via debugfs, even when the module is unloaded/reloaded. When zero, profiling data is discarded and associated debugfs files are removed at module unload time.

gdth= [HW.SCSI]
See header of drivers/scsi/gdth.c.

gpt [EFI] Forces disk with valid GPT signature but invalid Protective MBR to be treated as GPT.
845  gvp11= [HW,SCSI]
847
848  hashdist= [KNL,NUMA] Large hashes allocated during boot are distributed across NUMA nodes. Defaults on for 64bit NUMA, off otherwise.
850  Format: 0 | 1 (for off | on)
852
853  hcl= [IA-64] SGI's Hardware Graph compatibility layer
854
855  hd= [EIDE] (E)IDE hard drive subsystem geometry
856  Format: <cyl>,<head>,<sect>
857
858  hest_disable [ACPI]
859  Disable Hardware Error Source Table (HEST) support; corresponding firmware-first mode error processing logic will be disabled.
862
863  highmem=nn[KMG] [KNL,BOOT] forces the highmem zone to have an exact size of <nn>. This works even on boxes that have no highmem otherwise. This also works to reduce highmem
866  size on bigger boxes.
867
868  highres= [KNL] Enable/disable high resolution timer mode.
869  Valid parameters: "on", "off"
870  Default: "on"
871
872  hisax= [HW,ISDN]
873  See Documentation/isdn/README.HiSax.
874
875  hlt [BUGS=ARM,SH]
876
877  hpet= [X86-32,HPET] option to control HPET usage
878  Format: { enable (default) | disable | force |
879       verbose }
880  disable: disable HPET and use PIT instead
881  force: allow force enabled of undocumented chips
882  (ICH4, VIA, nVidia)
883  verbose: show contents of HPET registers during setup
884
885  hugepages= [HW,X86-32,IA-64] HugeTLB pages to allocate at boot.
886  hugepagesz= [HW,IA-64,PPC,X86-64] The size of the HugeTLB pages.
887  On x86-64 and powerpc, this option can be specified
multiple times interleaved with hugepages= to reserve huge pages of different sizes. Valid pages sizes on x86-64 are 2M (when the CPU supports "pse") and 1G (when the CPU supports the "pdpe1gb" cpuninfo flag). Note that 1GB pages can only be allocated at boot time using hugepages= and not freed afterwards.

hvc_iucv= [S390] Number of z/VM IUCV hypervisor console (HVC)

terminal devices. Valid values: 0..8

hvc_iucv_allow= [S390] Comma-separated list of z/VM user IDs.

If specified, z/VM IUCV HVC accepts connections from listed z/VM user IDs only.

deb= [HW] Override the default board specific I2C bus speed

or register an additional I2C bus that is not registered from board initialization code.

Format: <bus_id>,<clkrate>

deb= [HW] Toggle i8042 debug mode

direct= [HW] Put keyboard port into non-translated mode

dumbkbd= [HW] Pretend that controller can only read data from keyboard and cannot control its state

(Don’t attempt to blink the leds)

noaux= [HW] Don’t check for auxiliary (= mouse) port

nokbd= [HW] Don’t check/create keyboard port

noloop= [HW] Disable the AUX Loopback command while probing

for the AUX port

donumux= [HW] Don’t check presence of an active multiplexing controller

opnp= [HW] Don’t use ACPI PnP / PnP BIOS to discover controllers

panicblink= [HW] Frequency with which keyboard LEDs should blink when kernel panics (default is 0.5 sec)

reset= [HW] Reset the controller during init and cleanup

unlock= [HW] Unlock (ignore) the keylock

810= [HW,DRM]
i8k.ignore_dmi  [HW] Continue probing hardware even if DMI data indicates that the driver is running on unsupported hardware.

i8k.force  [HW] Activate i8k driver even if SMM BIOS signature does not match list of supported models.

i8k.power_status  [HW] Report power status in /proc/i8k (disabled by default)

i8k.restricted  [HW] Allow controlling fans only if SYS_ADMIN capability is set.

ibmmcascsi=  [HW,MCA,SCSI] IBM MicroChannel SCSI adapter See Documentation/mca.txt.

icn=  [HW,ISDN] Format: <io>,[<membase>[<icn_id>[<icn_id2>]]]

ide-core.nodma=  [HW] (E)IDE subsystem Format: =0.0 to prevent dma on hda, =0.1 hd1b =1.0 hdc .vlb_clock .pci_clock .noflush .nohp .noprobe .nowerr .cdrom .chs .ignore_cable are additional options See Documentation/ide/ide.txt.

ide-pci-generic.all-generic-ide  [HW] (E)IDE subsystem Claim all unknown PCI IDE storage controllers.

idle=  [X86] Format: idle=poll, idle=mwait, idle=halt, idle=nomwait Poll forces a polling idle loop that can slightly improve the performance of waking up a idle CPU, but will use a lot of power and make the system run hot. Not recommended.

idle=mwait: On systems which support MONITOR/MWAIT but the kernel chose to not use it because it doesn't save as much power as a normal idle loop, use the MONITOR/MWAIT idle loop anyways. Performance should be the same as idle=poll.

idle=halt: Halt is forced to be used for CPU idle. In such case C2/C3 won't be used again.

idle=nomwait: Disable mwait for CPU C-states

ignore_loglevel  [KNL] Ignore loglevel setting - this will print /all/ kernel messages to the console. Useful for debugging.
ihash_entries= [KNL]
Set number of hash buckets for inode cache.

ima_audit= [IMA]
Format: { "0" | "1" }
0 -- integrity auditing messages. (Default)
1 -- enable informational integrity auditing messages.

ima_hash= [IMA]
Format: { "sha1" | "md5" }
default: "sha1"

ima_tcb [IMA]
Load a policy which meets the needs of the Trusted Computing Base. This means IMA will measure all programs exec'd, files mmap'd for exec, and all files opened for read by uid=0.

in2000= [HW,SCSI]
See header of drivers/nesi/in2000.c.

init= [KNL]
Format: <full_path>
Run specified binary instead of /sbin/init as init process.

initcall_debug [KNL] Trace initcalls as they are executed. Useful for working out where the kernel is dying during startup.

initrd= [BOOT] Specify the location of the initial ramdisk

inport.irq= [HW] Inport (ATI XL and Microsoft) busmouse driver

intel_iommu= [DMAR] Intel IOMMU driver (DMAR) option
  on
  off
  igfx_off [Default Off]
  by default, gfx is mapped as normal device. If a gfx
  device has a dedicated DMAR unit, the DMAR unit is
  bypassed by not enabling DMAR with this option. In
  this case, gfx device will use physical address for
  DMA.
forcedac [x86_64]
With this option iommu will not optimize to look
for io virtual address below 32 bit forcing dual address cycle on pci bus for cards supporting greater than 32 bit addressing. The default is to look for translation below 32 bit and if not available then look in the higher range.

strict [Default Off]

With this option on every unmap_single operation will result in a hardware IOTLB flush operation as opposed to batching them for performance.

inttest= [IA64]

iomem= Disable strict checking of access to MMIO memory

strict regions from userspace.

relaxed

iommu= [x86]

off

force

noforce

biomerge

panic

nopanic

merge

nomerge

forcesac

soft

pt [x86, IA64]

io7= [HW] IO7 for Marvel based alpha systems

See comment before marvel Specify io7 in arch/alpha/kernel/core_marvel.c.

io_delay= [X86] I/O delay method

0x80 Standard port 0x80 based delay

0xed Alternate port 0xed based delay (needed on some systems)

udelay Simple two microseconds delay

none No delay

ip= [IP_PNP]

See Documentation/filesystems/nfs/nfsroot.txt.
ip2= [HW] Set IO/IRQ pairs for up to 4 IntelliPort boards
See comment before ip2_setup() in drivers/char/ip2/ip2base.c.
ips= [HW,SCSI] Adaptec / IBM ServeRAID controller
See header of drivers/scsi/ips.c.
irqfixup [HW]
When an interrupt is not handled search all handlers
for it. Intended to get systems with badly broken
firmware running.
irqpoll [HW]
When an interrupt is not handled search all handlers
for it. Also check all handlers each timer
interrupt. Intended to get systems with badly broken
firmware running.
isapnp= [ISAPNP]
Format: <RDP>,<reset>,<pci_scan>,<verbosity>
isolcups= [KNL,SMP] Isolate CPUs from the general scheduler.
Format:
<cpu number>,.....<cpu number>
or
<cpu number>-<cpu number>
(must be a positive range in ascending order)
or a mixture
<cpu number>,.....<cpu number>-<cpu number>

This option can be used to specify one or more CPUs
to isolate from the general SMP balancing and
scheduling algorithms. You can move a process onto or off an
"isolated" CPU via the CPU affinity syscalls or cpuset.
<cpu number> begins at 0 and the maximum value is
"number of CPUs in system - 1".

This option is the preferred way to isolate CPUs. The
alternative -- manually setting the CPU mask of all
tasks in the system -- can cause problems and
suboptimal load balancer performance.
js= [HW,JOY] Analog joystick
See Documentation/input/joystick.txt.
keepinitrd [HW,ARM]

kernelcore=nn[KMG] [KNL,X86,IA-64,PPC] This parameter specifies the amount of memory usable by the kernel for non-movable allocations. The requested amount is spread evenly throughout all nodes in the system. The remaining memory in each node is used for Movable pages. In the event, a node is too small to have both kernelcore and Movable pages, kernelcore pages will take priority and other nodes will have a larger number of kernelcore pages. The Movable zone is used for the allocation of pages that may be reclaimed or moved by the page migration subsystem. This means that HugeTLB pages may not be allocated from this zone. Note that allocations like PTEs-from-HighMem still use the HighMem zone if it exists, and the Normal zone if it does not.

kmemleak= [KNL] Boot-time kmemleak enable/disable
Valid arguments: on, off
Default: on

kgdbdbgp= [KGDB,HW] kgdb over EHCI USB debug port.
Format: <Controller#>[,.poll interval]
The controller # is the number of the ehci USB debug port as it is probed via PCI. The poll interval is optional and is the number seconds in between each poll cycle to the debug port in case you need the functionality for interrupting the kernel with gdb or control-c on the dbgp connection. When not using this parameter you use sysrq-g to break into the kernel debugger.

kgdboc= [KGDB,HW] kgdb over consoles.
Requires a tty driver that supports console polling, or a supported polling keyboard driver (non-USB).
Serial only format: <serial_device>[,.baud]
keyboard only format: kbd
keyboard and serial format: kbd,<serial_device>[,.baud]

kgdbwait [KGDB] Stop kernel execution and enter the kernel debugger at the earliest opportunity.

kmac= [MIPS] korina ethernet MAC address.
Configure the RouterBoard 532 series on-chip Ethernet adapter MAC address.

kmemleak= [KNL] Boot-time kmemleak enable/disable
Valid arguments: on, off
Default: on
kstack=N  [X86] Print N words from the kernel stack in oops dumps.

kvm.ignore_msrs=[KVM] Ignore guest accesses to unhandled MSRs. Default is 0 (don't ignore, but inject #GP)

kvm.oos_shadow= [KVM] Disable out-of-sync shadow paging. Default is 1 (enabled)

kvm-amd.nested= [KVM,AMD] Allow nested virtualization in KVM/SVM. Default is 0 (off)

kvm-amd.npt=[KVM,AMD] Disable nested paging (virtualized MMU) for all guests. Default is 1 (enabled) if in 64bit or 32bit-PAE mode

kvm-intel.bypass_guest_pf= [KVM,Intel] Disables bypassing of guest page faults on Intel chips. Default is 1 (enabled)

kvm-intel.epi=[KVM,Intel] Disable extended page tables (virtualized MMU) support on capable Intel chips. Default is 1 (enabled)

kvm-intel.emulate_invalid_guest_state= [KVM,Intel] Enable emulation of invalid guest states. Default is 0 (disabled)

kvm-intel.flexpriority= [KVM,Intel] Disable FlexPriority feature (TPR shadow). Default is 1 (enabled)

kvm-intel.unrestricted_guest= [KVM,Intel] Disable unrestricted guest feature (virtualized real and unpaged mode) on capable Intel chips. Default is 1 (enabled)

kvm-intel.vpid= [KVM,Intel] Disable Virtual Processor Identification feature (tagged TLBs) on capable Intel chips. Default is 1 (enabled)

l2cr= [PPC]

l3cr= [PPC]
lapic [X86-32.APIC] Enable the local APIC even if BIOS disabled it.

lapic_timer_c2_ok [X86,APIC] trust the local apic timer in C2 power state.

libata.dma= [LIBATA] DMA control
libata.dma=0 Disable all PATA and SATA DMA
libata.dma=1 PATA and SATA Disk DMA only
libata.dma=2 ATAPI (CDROM) DMA only
libata.dma=4 Compact Flash DMA only
Combinations also work, so libata.dma=3 enables DMA for disks and CDROMs, but not CFs.

libata.ignore_hpa= [LIBATA] Ignore HPA limit
libata.ignore_hpa=0 keep BIOS limits (default)
libata.ignore_hpa=1 ignore limits, using full disk

libata.noacpi [LIBATA] Disables use of ACPI in libata suspend/resume
when set.
Format: <int>

libata.force= [LIBATA] Force configurations. The format is comma separated list of "[ID:]VAL" where ID is matching port, link or device. Basics, it matches the ATA ID string printed on console by libata. If the whole ID part is omitted, the last PORT and DEVICE values are used. If ID hasn't been specified yet, the configuration applies to all ports, links and devices.

If only DEVICE is omitted, the parameter applies to the port and all links and devices behind it. DEVICE number of 0 either selects the first device or the first fan-out link behind PMP device. It does not select the host link. DEVICE number of 15 selects the host link and device attached to it.
The VAL specifies the configuration to force. As long as there's no ambiguity shortcut notation is allowed.

For example, both 1.5 and 1.5G would work for 1.5Gbps.
The following configurations can be forced.
* Cable type: 40c, 80c, short40c, unk, ign or sata. Any ID with matching PORT is used.

* SATA link speed limit: 1.5Gbps or 3.0Gbps.

* Transfer mode: pio[0-7], mwdma[0-4] and udma[0-7]. udma/[16,25,33,44,66,100,133] notation is also allowed.

* [no]ncq: Turn on or off NCQ.

* nohrst, nosrst, norst: suppress hard, soft and both resets.

* dump_id: dump IDENTIFY data.

If there are multiple matching configurations changing the same attribute, the last one is used.

memblock=debug    [KNL] Enable membblock debug messages.

load_ramdisk=[RAM] List of ramdisks to load from floppy

    See Documentation/blockdev/ramdisk.txt.

lockd.nlm_grace_period=P [NFS] Assign grace period.
    Format: <integer>

    Format: <integer>

    Format: <integer>

    Format: <integer>

logibm.irq=     [HW.MOUSE] Logitech Bus Mouse Driver
    Format: <irq>

loglevel=     All Kernel Messages with a loglevel smaller than the console loglevel will be printed to the console. It can also be changed with klogd or other programs. The loglevels are defined as follows:

0 (KERN_EMERG) system is unusable
1294 1 (KERN_ALERT) action must be taken immediately
1295 2 (KERN_CRIT) critical conditions
1296 3 (KERN_ERR) error conditions
1297 4 (KERN_WARNING) warning conditions
1298 5 (KERN_NOTICE) normal but significant condition
1299 6 (KERN_INFO) informational
1300 7 (KERN_DEBUG) debug-level messages
1301
1302 log_buf_len=n Sets the size of the printk ring buffer, in bytes.
1303 Format: { n | nk | nM } 
1304 n must be a power of two. The default size
1305 is set in the kernel config file.
1306
1307 logo.nologo [FB] Disables display of the built-in Linux logo.
1308 This may be used to provide more screen space for
1309 kernel log messages and is useful when debugging
1310 kernel boot problems.
1311
1312 lp=0 [LP] Specify parallel ports to use, e.g.
1313 lp=port[,port...] lp=none.parport0 (lp0 not configured, lp1 uses
1314 lp=reset first parallel port). 'lp=0' disables the
1315 lp=auto printer driver. 'lp=reset' (which can be
1316 specified in addition to the ports) causes
1317 attached printers to be reset. Using
1318 lp=port1,port2,... specifies the parallel ports
1319 to associate lp devices with, starting with
1320 lp0. A port specification may be 'none' to skip
1321 that lp device, or a parport name such as
1322 'parport0'. Specifying 'lp=auto' instead of a
1323 port specification list means that device IDs
1324 from each port should be examined, to see if
1325 an IEEE 1284-compliant printer is attached; if
1326 so, the driver will manage that printer.
1327 See also header of drivers/char/lp.c.
1328
1329 lp=n [KNL]
1330 Sets loops_per_jiffy to given constant, thus avoiding
1331 time-consuming boot-time autodetection (up to 250 ms
1332 per
1333 CPU). 0 enables autodetection (default). To determine
1334 the correct value for your kernel, boot with normal
1335 autodetection and see what value is printed. Note that
1336 on SMP systems the preset will be applied to all CPUs,
1337 which is likely to cause problems if your CPUs need
1338 significantly divergent settings. An incorrect value
1339 will cause delays in the kernel to be wrong, leading to
unpredictable I/O errors and other breakage. Although unlikely, in the extreme case this might damage your hardware.

ltpc=[NET] Format: <io>,<irq>,<dma>

mac5380=[HW,SCSI] Format:
<can_queue>,<cmd_per_lun>,<sg_tablesize>,<hostid>,<use_tags>

machvec=[IA64] Force the use of a particular machine-vector (machvec) in a generic kernel.
Example: machvec=hpzx1_swiotlb

machtype=[Loongson] Share the same kernel image file between different yeeeloong laptop.
Example: machtype=lemote-yeeeloong-2f-7inch

max_addr=nn[KMG] [KNL,BOOT,ia64] All physical memory greater than or equal to this physical address is ignored.

maxcpus=[SMP] Maximum number of processors that an SMP kernel should make use of. maxcpus=n : n >= 0 limits the kernel to using 'n' processors. n=0 is a special case, it is equivalent to "nosmp", which also disables the IO APIC.

max_loop=[LOOP] Maximum number of loopback devices that can be mounted
Format: <1-256>

max_luns=[SCSI] Maximum number of LUNs to probe. Should be between 1 and 2^32-1.

max_report_luns=

max_luns=[SCSI] Maximum number of LUNs received. Should be between 1 and 16384.

mcatest=[IA-64]
mce=[X86-32] Machine Check Exception
mce=option  [X86-64] See Documentation/x86/x86_64/boot-options.txt

md=  [HW] RAID subsystems devices and level
See Documentation/md.txt.

mdacon=  [MDA]
Format: <first>,<last>
Specifies range of consoles to be captured by the
MDA.

mem=nn[KMG]  [KNL,BOOT] Force usage of a specific amount
of memory
Amount of memory to be used when the kernel is not
able to see the whole system memory or for test.
[XS86-32] Use together with memmap= to avoid
physical devices
address space collisions. Without memmap= PCI
RAM.

mem=nopentium  [BUGS=X86-32] Disable usage of 4MB pages
for kernel
memory.

memchunk=nn[KMG]
[KNL,SH] Allow user to override the default size for
per-device physically contiguous DMA buffers.

memmap=exactmap  [KNL,X86] Enable setting of an exact
E820 memory map, as specified by the user.
Such memmap=exactmap lines can be constructed
based on BIOS output or other requirements. See the
memmap=nn@ss
option description.

memmap=nn[KMG]@ss[KMG]
[KNL] Force usage of a specific region of memory
Region of memory to be used, from ss to ss+nn.

memmap=nn[KMG]@ss[KMG]
[KNL,ACPI] Mark specific memory as ACPI data.
Region of memory to be used, from ss to ss+nn.

memmap=nn[KMG]$ss[KMG]
0x1869fff

memmap=64K$0x18690000
or
memmap=0x10000$0x18690000

memory_corruption_check=0/1 [X86]
Some BIOSes seem to corrupt the first 64k of
memory when doing things like suspend/resume.
Setting this option will scan the memory
looking for corruption. Enabling this will
both detect corruption and prevent the kernel
from using the memory being corrupted.
However, its intended as a diagnostic tool; if
repeatable BIOS-originated corruption always
affects the same memory, you can use memmap=*
to prevent the kernel from using that memory.

memory_corruption_check_size=size [X86]
By default it checks for corruption in the low
64k, making this memory unavailable for normal
use. Use this parameter to scan for
corruption in more or less memory.

memory_corruption_check_period=seconds [X86]
By default it checks for corruption every 60
seconds. Use this parameter to check at some
other rate. 0 disables periodic checking.

memtest= [KNL,X86] Enable memtest
Format: <integer>
default : 0 <disable>
Specifies the number of memtest passes to be
performed. Each pass selects another test
pattern from a given set of patterns. Memtest
fills the memory with this pattern, validates
memory contents and reserves bad memory
regions that are detected.

meye.*= [HW] Set MotionEye Camera parameters
See Documentation/video4linux/meye.txt.

mfgpt_irq= [IA-32] Specify the IRQ to use for the
Multi-Function General Purpose Timers on AMD
Geode platforms.
mfgptfix [X86-32] Fix MFGPT timers on AMD Geode platforms when the BIOS has incorrectly applied a workaround. TinyBIOS version 0.98 is known to be affected, 0.99 fixes the problem by letting the user disable the workaround.
mga= [HW,DRM]
min_addr=nn[KMG] [KNL,BOOT,ia64] All physical memory below this physical address is ignored.
mini2440= [ARM,HW,KNL] Format:[0,2][b][c][t]
Default: "0tb"
MINI2440 configuration specification:
0 - The attached screen is the 3.5" TFT
1 - The attached screen is the 7" TFT
2 - The VGA Shield is attached (1024x768)
Leaving out the screen size parameter will not load the TFT driver, and the framebuffer will be left unconfigured.
b - Enable backlight. The TFT backlight pin will be linked to the kernel VESA blanking code and a GPIO LED. This parameter is not necessary when using the VGA shield.
c - Enable the s3c camera interface.
t - Reserved for enabling touchscreen support. The touchscreen support is not enabled in the mainstream kernel as of 2.6.30, a preliminary port can be found in the "bleeding edge" mini2440 support kernel at http://repo.or.cz/w/linux-2.6/mini2440.git
mminit_loglevel= [KNL] When CONFIG_DEBUG_MEMORY_INIT is set, this parameter allows control of the logging verbosity for the additional memory initialisation checks. A value of 0 disables mminit logging and a level of 4 will log everything. Information is printed at KERN_DEBUG
mousedev.tap_time= [MOUSE] Maximum time between finger touching and
leaving touchpad surface for touch to be considered a tap and be reported as a left button click (for touchpads working in absolute mode only).

Format: <msecs>

mousedev.xres= [MOUSE] Horizontal screen resolution, used for devices reporting absolute coordinates, such as tablets

mousedev.yres= [MOUSE] Vertical screen resolution, used for devices reporting absolute coordinates, such as tablets

movablecore=nn[KMG] [KNL,X86,IA-64,PPC] This parameter is similar to kernelcore except it specifies the amount of memory used for migratable allocations. If both kernelcore and movablecore is specified, then kernelcore will be at *least* the specified value but may be more. If movablecore on its own is specified, the administrator must be careful that the amount of memory usable for all allocations is not too small.

mpu401= [HW, OSS] Format: <io>,<irq>

MTD_Partition= [MTD] Format: <name>,<region-number>,<size>,<offset>

MTD_Regions= [MTD] Format: <name>,<region-number>[,<base>,<size>,<buswidth>,<altbuswidth>]

mtdparts= [MTD] See drivers/mtd/cmdlinepart.c.

onenand.bdry= [HW, MTD] Flex-OneNAND Boundary Configuration

Format: [die0_boundary][,die0_lock][,die1_boundary][,die1_lock]

boundary - index of last SLC block on Flex-OneNAND.

The remaining blocks are configured as MLC blocks.

lock - Configure if Flex-OneNAND boundary should be locked.

Once locked, the boundary cannot be changed.
1 indicates lock status, 0 indicates unlock status.

mtdset= [ARM]
ARM/S3C2412 JIVE boot control

See arch/arm/mach-s3c2412/mach-jive.c

mtouchUSB.raw_coordinates=
[HW] Make the MicroTouch USB driver use raw coordinates
('y', default) or cooked coordinates ('n')

mtrr_chunk_size=nn[KMG] [X86]
used for mtrr cleanup. It is largest continuous chunk
that could hold holes aka. UC entries.

mtrr_gran_size=nn[KMG] [X86]
Used for mtrr cleanup. It is granularity of mtrr block.
Default is 1.
Large value could prevent small alignment from
using up MTRRs.

mtrr_spare_reg_n=n [X86]
Format: <integer>
Range: 0,7: spare reg number
Default: 1
Used for mtrr cleanup. It is spare mtrr entries number.
Set to 2 or more if your graphical card needs more.

n2= [NET] SDL Inc. RISCom/N2 synchronous serial card

NCR_D700= [HW,SCSI]
See header of drivers/scsi/NCR_D700.c.

ncr5380= [HW,SCSI]

ncr53c400= [HW,SCSI]

ncr53c400a= [HW,SCSI]

ncr53c406a= [HW,SCSI]

ncr53c8xx= [HW,SCSI]

netdev= [NET] Network devices parameters
Format:
<irq>,<io>,<mem_start>,<mem_end>,<name>
Note that mem_start is often overloaded to mean something different and driver-specific. This usage is only documented in each driver source file if at all.

nf_conntrackacct=

[NETFILTER] Enable connection tracking flow accounting

0 to disable accounting
1 to enable accounting
Default value depends on CONFIG_NF_CT_ACCT that is going to be removed in 2.6.29.

nfsaddr=

See Documentation/filesystems/nfs/nfsroot.txt.

nfsroot=

See Documentation/filesystems/nfs/nfsroot.txt.

nfs.callback_tcpport=

[NFS] set the TCP port on which the NFSv4 callback channel should listen.

nfs.cache_getent=

[NFS] sets the pathname to the program which is used to update the NFS client cache entries.

nfs.cache_getent_timeout=

[NFS] sets the timeout after which an attempt to update a cache entry is deemed to have failed.

nfs.idmap_cache_timeout=

[NFS] set the maximum lifetime for idmapper cache entries.

nfs.enable_ino64=

[NFS] enable 64-bit inode numbers.
If zero, the NFS client will fake up a 32-bit inode number for the readdir() and stat() syscalls instead of returning the full 64-bit number.
The default is to return 64-bit inode numbers.

nmi_debug=

[KNL,AVR32.SH] Specify one or more actions to take when a NMI is triggered.
Format: [state][,regs][,debounce][,die]
nmi_watchdog= [KNL,BUGS=X86] Debugging features for
SMP kernels
Format: [panic.][num]
Valid num: 0,1,2
0 - turn nmi_watchdog off
1 - use the IO-APIC timer for the NMI watchdog
2 - use the local APIC for the NMI watchdog using
a performance counter. Note: This will use one
performance counter and the local APIC's performance
vector.
When panic is specified, panic when an NMI watchdog
timeout occurs.
This is useful when you use a panic=... timeout and
need the box quickly up again.
Instead of 1 and 2 it is possible to use the following
symbolic names: lapic and ioapic
Example: nmi_watchdog=2 or
nmi_watchdog=panic,lapic
netpoll.carrier_timeout=
[NET] Specifies amount of time (in seconds) that
netpoll should wait for a carrier. By default netpoll
waits 4 seconds.
no387 [BUGS=X86-32] Tells the kernel to use the 387 maths
emulation library even if a 387 maths coprocessor
is present.
no_console_suspend
[HW] Never suspend the console
Disable suspending of consoles during suspend and
hibernate operations. Once disabled, debugging
messages can reach various consoles while the rest
of the system is being put to sleep (ie, while
driving suspend/resume hooks). This may
not work reliably with all consoles, but is known
to work with serial and VGA consoles.
noaliencache [MM, NUMA, SLAB] Disables the allocation of alien
caches in the slab allocator. Saves per-node memory,
but will impact performance.
noalign [KNL,ARM]
noapic [SMP,APIC] Tells the kernel to not make use of any
IOAPICs that may be present in the system.
nobats [PPC] Do not use BATs for mapping kernel lowmem
on "Classic" PPC cores.

tocache [ARM]
noclflush [BUGS=X86] Don't use the CLFLUSH instruction

nodelayacct [KNL] Disable per-task delay accounting

nodisconnect [HW,SCSI,M68K] Disables SCSI disconnects.

nodsp [SH] Disable hardware DSP at boot time.

noesi [X86] Disable EFI runtime services support.

noexec [IA-64]

noexec [X86]

On X86-32 available only on PAE configured kernels.

noexec=on: enable non-executable mappings (default)

noexec=off: disable non-executable mappings

This affects only 32-bit executables.

noexec32=on: enable non-executable mappings (default)

read doesn't imply executable mappings

noexec32=off: disable non-executable mappings

read implies executable mappings

nofpu [SH] Disable hardware FPU at boot time.

nofxr [BUGS=X86-32] Disables x86 floating point extended register save and restore. The kernel will only save legacy floating-point registers on task switch.

noxsave [BUGS=X86] Disables x86 extended register state save

and restore using xsave. The kernel will fallback to enabling legacy floating-point and sse state.

nohlt [BUGS=ARM,SH] Tells the kernel that the sleep(SH) or wfi(ARM) instruction doesn't work correctly and not to use it. This is also useful when using JTAG debugger.

no-hlt [BUGS=X86-32] Tells the kernel that the hlt instruction doesn't work correctly and not to use it.
no_file_caps

Tells the kernel not to honor file capabilities. The only way then for a file to be executed with privilege is to be setuid root or executed by root.

nohalt

[IA-64] Tells the kernel not to use the power saving function PAL_HALT_LIGHT when idle. This increases power-consumption. On the positive side, it reduces interrupt wake-up latency, which may improve performance in certain environments such as networked servers or real-time systems.

nohz=

[KNL] Boottime enable/disable dynamic ticks
Valid arguments: on, off
Default: on

noiotrap

[SH] Disables trapped I/O port accesses.

noirqdebug

[X86-32] Disables the code which attempts to detect and disable unhandled interrupt sources.

no_timer_check

[X86,APIC] Disables the code which tests for broken timer IRQ sources.

noisapnp


nomintrd

[RAM] Tells the kernel not to load any configured initial RAM disk.

nointremap

[X86-64, Intel-IOMMU] Do not enable interrupt remapping.

nointroute

[IA-64]

nojitter

[IA64] Disables jitter checking for ITC timers.

nolapic

[X86-32,APIC] Do not enable or use the local APIC.

nolapic_timer

[X86-32,APIC] Do not use the local APIC timer.

noltlbs

[PPC] Do not use large page/tlb entries for kernel lowmem mapping on PPC40x.

nomca

[IA-64] Disable machine check abort handling
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>nomce</td>
<td>[X86-32] Machine Check Exception</td>
<td></td>
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<tr>
<td>nomfgpt</td>
<td>[X86-32] Disable Multi-Function General Purpose</td>
<td></td>
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<tr>
<td>nopat</td>
<td>[X86] Disable PAT (page attribute table extension of pagetables) support.</td>
<td></td>
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<tr>
<td>norandmaps</td>
<td>Don't use address space randomization. Equivalent to echo 0 &gt; /proc/sys/kernel/randomize_va_space</td>
<td></td>
</tr>
<tr>
<td>noreplace-paravirt</td>
<td>[X86-32,PV_OPS] Don't patch paravirt_ops</td>
<td></td>
</tr>
<tr>
<td>noreplace-smp</td>
<td>[X86-32,SMP] Don't replace SMP instructions with UP alternatives</td>
<td></td>
</tr>
<tr>
<td>noresidual</td>
<td>[PPC] Don't use residual data on PReP machines.</td>
<td></td>
</tr>
<tr>
<td>noresume</td>
<td>[SWSUSP] Disables resume and restores original swap space.</td>
<td></td>
</tr>
<tr>
<td>nosbagart</td>
<td>[IA-64]</td>
<td></td>
</tr>
<tr>
<td>nosep</td>
<td>[BUGS=X86-32] Disables x86 SYSENTER/SYSEXIT support.</td>
<td></td>
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<tr>
<td>nosmp</td>
<td>[SMP] Tells an SMP kernel to act as a UP kernel, and disable the IO APIC. legacy for &quot;maxcpus=0&quot;.</td>
<td></td>
</tr>
<tr>
<td>nosoftlockup</td>
<td>[KNL] Disable the soft-lockup detector.</td>
<td></td>
</tr>
<tr>
<td>noswapaccount</td>
<td>[KNL] Disable accounting of swap in memory resource controller. (See Documentation/cgroups/memory.txt)</td>
<td></td>
</tr>
<tr>
<td>nosync</td>
<td>[HW,M68K] Disables sync negotiation for all devices.</td>
<td></td>
</tr>
<tr>
<td>notsc</td>
<td>[BUGS=X86-32] Disable Time Stamp Counter</td>
<td></td>
</tr>
<tr>
<td>noUSB</td>
<td>[USB] Disable the USB subsystem</td>
<td></td>
</tr>
<tr>
<td>nowb</td>
<td>[ARM]</td>
<td></td>
</tr>
</tbody>
</table>
nox2apic  [X86-64,APIC] Do not enable x2APIC mode.
nptcg= [IA64] Override max number of concurrent global
TLB
PAL_VM_SUMMARY or
SAL PALO.
nr_cpus= [SMP] Maximum number of processors that an SMP
kernel
could support. nr_cpus=n : n >= 1 limits the kernel to
supporting 'n' processors. Later in runtime you can not
use hotplug cpu feature to put more cpu back to online.
just like you compile the kernel NR_CPUS=n
nr_uarts= [SERIAL] maximum number of UARTs to be
registered.
numa_zonelist_order= [KNL, BOOT] Select zonelist order for
NUMA.
one of ['zone', 'node', 'default'] can be specified
This can be set from sysctl after boot.
See Documentation/sysctl/vm.txt for details.
ohci1394_dma=early [HW] enable debugging via the ohci1394
driver.
See Documentation/debugging-via-ohci1394.txt for
more
info.
olpc_ec_timeout= [OLPC] ms delay when issuing EC commands
Rather than timing out after 20 ms if an EC
command is not properly ACKed, override the length
of the timeout. We have interrupts disabled while
waiting for the ACK, so if this is set too high
interrupts *may* be lost!
omap_mux= [OMAP] Override bootloader pin multiplexing.
Format: <mux_mode0.mode_name=value>...
For example, to override I2C bus2:
omap_mux=i2c2_scl,i2c2_sda=0x100,i2c2_sda=i2c2_sda=0x100
opl3= [HW,OSS]
Format: <io>
oprofile.timer= [HW]
Use timer interrupt instead of performance counters
oprofile.cpu_type= Force an oprofile cpu type
This might be useful if you have an older oprofile
userland or if you want common events.
Format: { arch_perfmon }
arch_perfmon: [X86] Force use of architectural
perfmon on Intel CPUs instead of the
CPU specific event set.

osst= [HW,SCSI] SCSI Tape Driver
Format: <buffer_size>,<write_threshold>
See also Documentation/scsi/st.txt.

panic= [KNL] Kernel behaviour on panic
Format: <timeout>

parkbd.port= [HW] Parallel port number the keyboard adapter is
connected to, default is 0.
Format: <parport#>

parkbd.mode= [HW] Parallel port keyboard adapter mode of
operation,
0 for XT, 1 for AT (default is AT).
Format: <mode>

parport= [HW,PPT] Specify parallel ports. 0 disables.
Format: { 0 | auto | 0xBBB|[IRQ],[DMA] } 
Use 'auto' to force the driver to use any
IRQ/DMA settings detected (the default is to
ignore detected IRQ/DMA settings because of
possible conflicts). You can specify the base
address, IRQ, and DMA settings; IRQ and DMA
should be numbers, or 'auto' (for using detected
settings on that particular port), or 'nofifo'
(to avoid using a FIFO even if it is detected).
Parallel ports are assigned in the order they
are specified on the command line, starting
with parport0.

parport_init_mode= [HW,PPT]
Configure VIA parallel port to operate in
a specific mode. This is necessary on Pegasos
computer where firmware has no options for setting
up parallel port mode and sets it to spp.
Currently this function knows 686a and 8231 chips.
Format: [sppls2leppleclepepp]
pas2= [HW,OSS] Format:
<io>,<irq>,<dma>,<dma16>,<sb_io>,<sb_irq>,<sb_dma>,<sb_dma16>

pas16=  [HW,SCSI]
See header of drivers/scsi/pas16.c.

pause_on_oops=
Halt all CPUs after the first oops has been printed for
the specified number of seconds. This is to be used if
your oopses keep scrolling off the screen.

pcbit=  [HW,ISDN]

pcd.  [PARIDE]
See header of drivers/block/paride/pcd.c.
See also Documentation/blockdev/paride.txt.

pci=option[option,...]  [PCI] various PCI subsystem options:
earlydump  [X86] dump PCI config space before the kernel
changes anything
off  [X86] don't probe for the PCI bus
bios  [X86-32] force use of PCI BIOS, don't access
the hardware directly. Use this if your machine
has a non-standard PCI host bridge.
nobios  [X86-32] disallow use of PCI BIOS, only direct
hardware access methods are allowed. Use this
if you experience crashes upon bootup and you
suspect they are caused by the BIOS.
conf1  [X86] Force use of PCI Configuration
Mechanism 1.
conf2  [X86] Force use of PCI Configuration
Mechanism 2.
noaer  [PCIE] If the PCIEAER kernel config
parameter is
enabled, this kernel boot option can be used to
disable the use of PCIE advanced error
reporting.
nodomains  [PCI] Disable support for multiple PCI
root domains (aka PCI segments, in ACPI-
speak).
nommconf  [X86] Disable use of MMCONFIG for PCI
Configuration
check_enable_amd_mmcconf  [X86] check for and enable
properly configured MMIO access to PCI
config space on AMD family 10h CPU
nomsi  [MSI] If the PCI_MSI kernel config parameter
is
enabled, this kernel boot option can be used to
disable the use of MSI interrupts system-wide.

noioapicquirk [APIC] Disable all boot interrupt quirks.

Safety option to keep boot IRQs enabled. This should never be necessary.

ioapiceroute [APIC] Enable rerouting of boot IRQs to the primary IO-APIC for bridges that cannot boot IRQs. This fixes a source of spurious IRQs when the system masks IRQs.

noioapiceroute [APIC] Disable workaround that uses the boot IRQ equivalent of an IRQ that connects to a chipset where boot IRQs cannot be disabled.

The opposite of ioapiceroute.

biosirq [X86-32] Use PCI BIOS calls to get the routing table. These calls are known to be buggy on several machines and they hang the machine when used, but on other computers it's the only way to get the interrupt routing table. Try this option if the kernel is unable to allocate IRQs or discover secondary PCI buses on your motherboard.

rom [X86] Assign address space to expansion ROMs.

Use with caution as certain devices share address decoders between ROMs and other resources.

norom [X86] Do not assign address space to expansion ROMs that do not already have BIOS assigned address ranges.

irqmask=0xMMMMM [X86] Set a bit mask of IRQs allowed to be assigned automatically to PCI devices. You can make the kernel exclude IRQs of your ISA cards this way.

pirqaddr=0xAAAAAA [X86] Specify the physical address of the PIRQ table (normally generated by the BIOS) if it is outside the F0000h-100000h range.

lastbus=N [X86] Scan all buses thru bus #N. Can be useful if the kernel is unable to find your secondary buses and you want to tell it explicitly which ones they are.

assign-busses [X86] Always assign all PCI bus numbers ourselves, overriding
whatever the firmware may have done.

usepirqmask [X86] Honor the possible IRQ mask stored in the BIOS $SPIR table. This is needed on some systems with broken BIOSes, notably some HP Pavilion N5400 and Omnibook XE3 notebooks. This will have no effect if ACPI IRQ routing is enabled.

noacpi [X86] Do not use ACPI for IRQ routing or for PCI scanning.

use_crs [X86] Use PCI host bridge window information from ACPI. On BIOSes from 2008 or later, this is enabled by default. If you need to use this, please report a bug.

crcs [X86] Ignore PCI host bridge windows from ACPI. If you need to use this, please report a bug.

routeirq Do IRQ routing for all PCI devices.

This is normally done in pci_enable_device(), so this option is a temporary workaround for broken drivers that don't call it.

skip_isa_align [X86] do not align io start addr, so can handle more pci cards

firmware [ARM] Do not re-enumerate the bus but instead just use the configuration from the bootloader. This is currently used on IXP2000 systems where the bus has to be configured a certain way for adjunct CPUs.

noearly [X86] Don't do any early type 1 scanning.

This might help on some broken boards which machine check when some devices' config space is read. But various workarounds are disabled and some IOMMU drivers will not work.

bfsort Sort PCI devices into breadth-first order.

This sorting is done to get a device order compatible with older (<= 2.4) kernels.

nobfsort Don't sort PCI devices into breadth-first order.

cbiosize=nn[KMG] The fixed amount of bus space which is reserved for the CardBus bridge's IO window. The default value is 256 bytes.

cbmemsize=nn[KMG] The fixed amount of bus space which is reserved for the CardBus bridge's memory window. The default value is 64 megabytes.

resource_alignment=
<order of align>[AT][<domain>]:<bus>:[<func>]; ..[DOT]

2031 Specifies alignment and device to reassign
2032 aligned memory resources.
2033 If <order of align> is not specified,
2034 PAGE_SIZE is used as alignment.
2035 PCI-PCI bridge can be specified, if resource
2036 windows need to be expanded.
2037 ecr= Enable/disable PCIe ECRC (transaction layer
2038 end-to-end CRC checking).
2039 bios: Use BIOS/firmware settings. This is the
2040 the default.
2041 off: Turn ECRC off
2042 on: Turn ECRC on.
2043
2044 pcie_aspm= [PCIE] Forcibly enable or disable PCIe Active State
2045 Power
2046 Management.
2047 off Disable ASPM.
2048 force Enable ASPM even on devices that claim not to
2049 support it.
2050 WARNING: Forcing ASPM on may cause system
2051 lockups.
2052 pcie_pme= [PCIE,PM] Native PCIe PME signaling options:
2053 auto Use native PCIe PME signaling if the BIOS allows the
2054 kernel to control PCIe config registers of root ports.
2055 force Use native PCIe PME signaling even if the BIOS
2056 refuses to allow the kernel to control the relevant PCIe config
2057 registers.
2058 nomsi Do not use MSI for native PCIe PME signaling (this
2059 makes all PCIe root ports use INTx for everything).
2060 pcmod= [HW,PCMCIA] BadgePAD 4
2061 pd. [PARIDE]
2062 See Documentation/blockdev/paride.txt.
2063 pdcchassis= [PARISC,HW] Disable/Enable PDC Chassis Status
2064 codes at boot time.
2065 Format: { 0 | 1 }
2066 See arch/parisc/kernel/pdc_chassis.c
2067 percpu_alloc= Select which percpu first chunk allocator to use.
Currently supported values are "embed" and "page".
Archs may support subset or none of the selections.
See comments in mm/percpu.c for details on each
allocator. This parameter is primarily for debugging
and performance comparison.

```
2077      pf.      [PARIDE]
2078      See Documentation/blockdev/paride.txt.
2079
2080      pg.      [PARIDE]
2081      See Documentation/blockdev/paride.txt.
2082
2084      See Documentation/x86/i386/IO-APIC.txt.
2085
2086      plip=    [PPT,NET] Parallel port network link
2087      Format: \parport<nr> | timid | 0 \}
2088      See also Documentation/parport.txt.
2089
2091      Override pmtimer IOPort with a hex value.
2092      e.g. pmtmr=0x508
2093
2094      pnp.debug [PNP]
2095      Enable PNP debug messages. This depends on the
2096      CONFIG_PNP_DEBUG_MESSAGES option.
2097
2098      pnpacpi=  [ACPI]
2099          \{ off \}
2100
2101      pnpbios=  [ISAPNP]
2102          \{ on | off | curr | res | no-curr | no-res \}
2103
2104      pnp_reserve_irq= [ISAPNP] Exclude IRQs for the autoconfiguration
2105
2106      pnp_reserve_dma= [ISAPNP] Exclude DMAs for the autoconfiguration
2107
2108      pnp_reserve_io= [ISAPNP] Exclude I/O ports for the autoconfiguration
2109
2110      Ranges are in pairs (I/O port base and size).
2111
2112      pnp_reserve_mem= [ISAPNP] Exclude memory regions for the autoconfiguration.
2113
2114      Ranges are in pairs (memory base and size).
```
ports= [IP_VS_FTP] IPVS ftp helper module  
  Default is 21.  
  Up to 8 (IP_VS_APP_MAX_PORTS) ports  
  may be specified.  
  Format: <port>,<port>....

print-fatal-signals=  
  [KNL] debug: print fatal signals  
  If enabled, warn about various signal handling  
  related application anomalies: too many signals,  
  too many POSIX.1 timers, fatal signals causing a  
  coredump - etc.  
  If you hit the warning due to signal overflow,  
  you might want to try "ulimit -i unlimited".
  default: off.

printk.time=  
  Show timing data prefixed to each printk message line  
  Format: <bool> (1/Y/y=enable, 0/N/n=disable)

processor.max_cstate= [HW,ACPI]  
  Limit processor to maximum C-state  
  max_cstate=9 overrides any DMI blacklist limit.

processor.nocst [HW,ACPI]  
  Ignore the _CST method to determine C-states,  
  instead using the legacy FADT method

profile= [KNL] Enable kernel profiling via /proc/profile  
  Format: [schedule,]<number>  
  Param: "schedule" - profile schedule points.  
  Param: <number> - step/bucket size as a power of 2 for  
  statistical time based profiling.  
  Param: "sleep" - profile D-state sleeping (milliseconds).  
  Requires CONFIG_SCHEDSTATS  
  Param: "kvm" - profile VM exits.

prompt_ramdisk= [RAM] List of RAM disks to prompt for floppy  
  disk  
  before loading.  
  See Documentation/blockdev/ramdisk.txt.

psmouse.proto= [HW,MOUSE] Highest PS2 mouse protocol  
  extension to  
  probe for; one of (barelimpslexpsllifebooklany).
psmouse rate= [HW, MOUSE] Set desired mouse report rate, in reports per second.

psmouse resetafter= [HW, MOUSE]

Try to reset the device after so many bad packets

(0 = never).

psmouse resolution= [HW, MOUSE] Set desired mouse resolution, in dpi.

psmouse smartscroll= [HW, MOUSE] Controls Logitech smartscroll autorepeat.

0 = disabled, 1 = enabled (default).

ps= [HW, OSS] Personal Sound System (ECHO ESC614)

Format:

<io>, <mss_io>, <mss_irq>, <mss_dma>, <mpu_io>, <mpu_irq>

pt. [PARIDE]

See Documentation/blockdev/paride.txt.

pty.legacy_count= [KNL] Number of Legacy pty's. Overwrites compiled-in default number.

quiet [KNL] Disable most log messages

r128= [HW, DRM]

raid= [HW, RAID]

See Documentation/md.txt.

ramdisk_blocksize= [RAM]

See Documentation/blockdev/ramdisk.txt.

ramdisk_size= [RAM] Sizes of RAM disks in kilobytes

See Documentation/blockdev/ramdisk.txt.

rcupdate.blimit= [KNL, BOOT]

Set maximum number of finished RCU callbacks to process in one batch.

rcupdate.qimark= [KNL, BOOT]

Set threshold of queued RCU callbacks over which batch limiting is disabled.
rcupdate.qlowmark= [KNL,BOOT]
Set threshold of queued RCU callbacks below which batch limiting is re-enabled.

rdinit= [KNL]
Format: <full_path>
Run specified binary instead of /init from the ramdisk, used for early userspace startup. See initrd.

reboot= [BUGS=X86-32,BUGS=ARM,BUGS=IA-64]
Rebooting mode
Format: <reboot_mode>[,<reboot_mode2>[,...]]
See arch/*/kernel/reboot.c or arch/*/kernel/process.c

relax_domain_level= [KNL, SMP] Set scheduler's default relax_domain_level.
See Documentation/cgroups/cpusets.txt.

reserve= [KNL,BUGS] Force the kernel to ignore some iomem area

reservetop= [X86-32]
Format: nn[KMG]
Reserves a hole at the top of the kernel virtual address space.

reset_devices [KNL] Force drivers to reset the underlying device during initialization.

resume= [SWSUSP]
Specify the partition device for software suspend

resume_offset= [SWSUSP]
Specify the offset from the beginning of the partition given by "resume=" at which the swap header is located, in <PAGE_SIZE> units (needed only for swap files).
See Documentation/power/swsusp-and-swap-files.txt

retain_initrd [RAM] Keep initrd memory after extraction

rhash_entries=[KNL,NET]
Set number of hash buckets for route cache

riscom8= [HW,SERIAL]
Format: <io_board1>[,<io_board2>[,...<io_boardN>]]
ro  [KNL] Mount root device read-only on boot
root=  [KNL] Root filesystem
rootdelay=  [KNL] Delay (in seconds) to pause before attempting to mount the root filesystem
rootflags=  [KNL] Set root filesystem mount option string
rootfstype=  [KNL] Set root filesystem type
rootwait  [KNL] Wait (indefinitely) for root device to show up. Useful for devices that are detected asynchronously (e.g. USB and MMC devices).w  [KNL] Mount root device read-write on boot
S  [KNL] Run init in single mode
sa1100ir  [NET] See drivers/net/irda/sa1100_ir.c.
sbni=  [NET] Granch SBI12 leased line adapter
sched_debug  [KNL] Enables verbose scheduler debug messages.
scsi_debug_*=  [SCSI] See drivers/scsi/scsi_debug.c.
scsi_default_dev_flags=  [SCSI] SCSI default device flags
Format: <integer>
scsi_dev_flags=  [SCSI] Black/white list entry for vendor and model
Format: <vendor>:<model>:<flags>
(flags are integer value)
scsi_logging_level=  [SCSI] a bit mask of logging levels
See drivers/scsi/scsi_logging.h for bits. Also settable via sysctl at dev.scsi.logging_level (/proc/sys/dev/scsi/logging_level).
There is also a nice 'scsi_logging_level' script in the S390-tools package, available for download at http://www-128.ibm.com/developerworks/linux/linux390/s390-tools-1.5.4.html
scsi_mod.scan= [SCSI] sync (default) scans SCSI busses as they are discovered. async scans them in kernel threads, allowing boot to proceed. none ignores them, expecting user space to do the scan.

security= [SECURITY] Choose a security module to enable at boot. If this boot parameter is not specified, only the first security module asking for security registration will be loaded. An invalid security module name will be treated as if no module has been chosen.

selinux= [SELINUX] Disable or enable SELinux at boot time. Format: { "0" | "1" }

selinux= [SELINUX] Disable or enable SELinux at boot time. Format: { "0" | "1" }

Default value is set via kernel config option. If enabled at boot time, /selinux/disable can be used later to disable prior to initial policy load.

serialnumber [BUGS=X86-32]

shapers= [NET] Maximal number of shapers.

show_msr= [x86] show boot-time MSR settings

show_msr= [x86] show boot-time MSR settings

sim710= [SCSI,HW]

simeth= [IA-64]

simscsi= [HW,MTD]

slab_debug[=options[,slabs]] [MM, SLUB]

Enabling slab_debug allows one to determine the culprit if slab objects become corrupted. Enabling slab_debug can create guard zones around objects and may poison objects when not in use. Also tracks the
slub_max_order= [MM, SLUB]
Determines the maximum allowed order for slabs.
A high setting may cause OOMs due to memory fragmentation. For more information see Documentation/vm/slub.txt.

slub_min_objects= [MM, SLUB]
The minimum number of objects per slab. SLUB will increase the slab order up to slub_max_order to generate a sufficiently large slab able to contain the number of objects indicated. The higher the number of objects the smaller the overhead of tracking slabs and the less frequently locks need to be acquired.
For more information see Documentation/vm/slub.txt.

slub_min_order= [MM, SLUB]
Determines the minimum page order for slabs. Must be lower than slub_max_order.
For more information see Documentation/vm/slub.txt.

slub_nomerge [MM, SLUB]
Disable merging of slabs with similar size. May be necessary if there is some reason to distinguish allocs to different slabs. Debug options disable merging on their own.
For more information see Documentation/vm/slub.txt.

smart2= [HW]
Format: <io1>[,<io2>[,...,<io8>]]

smp-alt-once [X86-32,SMP] On a hotplug CPU system, only attempt to substitute SMP alternatives once at boot.

smsec-ircc2.nopnp [HW] Don't use PNP to discover SMC devices
smsec-ircc2.ircc_cfg=[HW] Device configuration I/O port
smsec-ircc2.ircc_sir=[HW] SIR base I/O port
smsec-ircc2.ircc_fir=[HW] FIR base I/O port
smsec-ircc2.ircc_irq=[HW] IRQ line
smsec-ircc2.ircc_dma=[HW] DMA channel
smsec-ircc2.ircc_transceiver=[HW] Transceiver type:
  0: Toshiba Satellite 1800 (GP data pin select)
  1: Fast pin select (default)
  2: ATC IRMode

snd-ad1816a= [HW,ALSA]
snd-gusextreme= [HW,ALSA]
snd-gusmax= [HW,ALSA]
snd-hdsp= [HW,ALSA]
snd-ice1712= [HW,ALSA]
snd-intel8x0= [HW,ALSA]
snd-interwave= [HW,ALSA]
snd-interwave-stb= [HW,ALSA]
snd-korg1212= [HW,ALSA]
snd-maestro3=[HW,ALSA]
snd-mpu401= [HW,ALSA]
snd-mpav= [HW,ALSA]
snd-nm256= [HW,ALSA]
snd-opl3sa2= [HW,ALSA]
snd-opti92x-ad1848= [HW,ALSA]
snd-opti92x-cs4231= [HW,ALSA]
snd-opti93x= [HW,ALSA]
snd-pmac= [HW,ALSA]
snd-rme32= [HW,ALSA]
snd-rme96= [HW,ALSA]
snd-rme9652= [HW,ALSA]
snd-sb8= [HW,ALSA]
snd-sb16= [HW,ALSA]
snd-bawe= [HW,ALSA]
snd-serial= [HW,ALSA]
snd-sgalaxy= [HW,ALSA]
snd-sonicvibes= [HW,ALSA]
snd-sun-amd7930= [HW,ALSA]
snd-sun-cs4231= [HW,ALSA]
snd-trident= [HW,ALSA]
snd-USB-audio= [HW,ALSA,USB]
snd-viam= [HW,ALSA]
snd-virmidi= [HW,ALSA]
snd-wavefront= [HW,ALSA]
snd-ymfpci= [HW,ALSA]
softlockup_panic= [KNL] Should the soft-lockup detector generate panics.
sonypi.*= [HW] Sony Programmable I/O Control Device driver
See Documentation/sonypi.txt
specialix= [HW,SERIAL] Specialix multi-serial port adapter
See Documentation/serial/specialix.txt.
spia_io_base= [HW,MTD]
spia_fio_base=
spia_pedr=
spia_peddr=
sscape= [HW,OSS]
Format: <io>,<irq>,<dma>,<mpu_io>,<mpu_irq>
st= [HW,SCSI] SCSI tape parameters (buffers, etc.)
See Documentation/scsi/st.txt.
stacktrace [FTRACE]
Enabled the stack tracer on boot up.
sti= [PARISC,HW]
Format: <num>
Set the STI (builtin display/keyboard on the HP-PARISC machines) console (graphic card) which should be used
as the initial boot-console.
See also comment in drivers/video/console/sticore.c.

sti_font= [HW]
See comment in drivers/video/console/sticore.c.

stifb= [HW]
Format: bpp:<bpp1>[[:<bpp2>[:<bpp3>...]]

sunrpc.min_resvport= 

sunrpc.max_resvport= [NFS,SUNRPC]
SunRPC servers often require that client requests originate from a privileged port (i.e. a port in the range 0 < portnr < 1024).
An administrator who wishes to reserve some of these ports for other uses may adjust the range that the kernel's sunrpc client considers to be privileged using these two parameters to set the minimum and maximum port values.

sunrpc.pool_mode= [NFS]
Control how the NFS server code allocates CPUs to service thread pools. Depending on how many NICs you have and where their interrupts are bound, this option will affect which CPUs will do NFS serving.
Note: this parameter cannot be changed while the NFS server is running.

auto the server chooses an appropriate mode
automatically using heuristics
global a single global pool contains all CPUs
percpu one pool for each CPU
pernode one pool for each NUMA node
(equivalent to global on non-NUMA machines)

sunrpc.tcp_slot_table_entries= 
sunrpc.udp_slot_table_entries= [NFS,SUNRPC]
Sets the upper limit on the number of simultaneous RPC calls that can be sent from the client to a
Increasing these values may allow you to improve throughput, but will also increase the amount of memory reserved for use by the client.

swiotlb= [IA-64] Number of I/O TLB slabs

switches= [HW,M68k]

sym53c416= [HW,SCSI]
See header of drivers/scsi/sym53c416.c.

sysrq_always_enabled
[KNL]
Ignore sysrq setting - this boot parameter will neutralize any effect of /proc/sys/kernel/sysrq.
Useful for debugging.

t128= [HW,SCSI]
See header of drivers/scsi/t128.c.

tdfx= [HW,DRM]

test_suspend= [SUSPEND]
Specify "mem" (for Suspend-to-RAM) or "standby" (for standby suspend) as the system sleep state to briefly enter during system startup. The system is woken from this state using a wakeup-capable RTC alarm.

thash_entries= [KNL,NET]
Set number of hash buckets for TCP connection

thermal.act= [HW,ACPI]
-1: disable all active trip points in all thermal zones
<degrees C>: override all lowest active trip points

thermal.crt=
[HW,ACPI]
-1: disable all critical trip points in all thermal zones
<degrees C>: override all critical trip points

thermal.nocrt=[HW,ACPI]
Set to disable actions on ACPI thermal zone critical and hot trip points.

thermal.off= [HW,ACPI]
1: disable ACPI thermal control

thermal.psv= [HW,ACPI]
-1: disable all passive trip points
(degrees C): override all passive trip points to this value
thermal.tzp= [HW,ACPI]
Specify global default ACPI thermal zone polling rate
(deci-seconds): poll all this frequency
0: no polling (default)
tmscsim= [HW,SCSI]
See comment before function dc390_setup() in drivers/scsi/tmscsim.c.
topology= [S390]
Format: {off, on}
Specify if the kernel should make use of the cpu topology informations if the hardware supports these.
The scheduler will make use of these informations and e.g. base its process migration decisions on it.
Default is off.
tp720= [HW,PS2]

Format: <string>

tpm_suspend_pcr=[HW,TPM]
Specify that at suspend time, the tpm driver should extend the specified pcr with zeros, as a workaround for some chips which fail to flush the last written pcr on TPM_SaveState.
This will guarantee that all the other pcrs are saved.

trace_buf_size=nn[KMG]
[FTRACE] will set tracing buffer size.
trace_event=[event-list]
[FTRACE] Set and start specified trace events in order to facilitate early boot debugging.
See also Documentation/trace/events.txt

trix= [HW,OSS] MediaTrix AudioTrix Pro
Format:

<io>,<irq>,<dma>,<dma2>,<sb_io>,<sb_irq>,<sb_dma>,<mpu_io>,<mpu
q>
tsc= Disable clocksource-must-verify flag for TSC.
Format: <string>
turbografx.map[2/3]= [HW,JOY]
TurboGraFX parallel port interface
Format:
<port#>,<js1>,<js2>,<js3>,<js4>,<js5>,<js6>,<js7>
See also Documentation/input/joystick-parport.txt

u14-34f= [HW,SCSI] UltraStor 14F/34F SCSI host adapter
See header of drivers/scsi/u14-34f.c.

uart401= [HW,OSS]
Format: <io>,<irq>

uart6850= [HW,OSS]
Format: <io>,<irq>

uhash_entries= [KNL.NET]
Set number of hash buckets for UDP/UDP-Lite connections

uhci-hcd.ignore_oc= [USB] Ignore overcurrent events (default N).
Some badly-designed motherboards generate lots of
bogus events, for ports that aren't wired to
anything. Set this parameter to avoid log spamming.
Note that genuine overcurrent events won't be
reported either.

unknown_nmi_panic= [X86]
Set unknown_nmi_panic=1 early on boot.

USBcore.autosuspend= [USB] The autosuspend time delay (in seconds) used
for newly-detected USB devices (default 2). This
is the time required before an idle device will be
autosuspended. Devices for which the delay is set
to a negative value won't be autosuspended at all.

USBcore.USBfs_snoop= [USB] Set to log all USBfs traffic (default 0 = off).

USBcore.blinkenlights= [USB] Set to cycle leds on hubs (default 0 = off).
USBcore.old_scheme_first=
    [USB] Start with the old device initialization scheme (default 0 = off).

USBcore.use_both_schemes=
    [USB] Try the other device initialization scheme if the first one fails (default 1 = enabled).

USBcore.initial_descriptor_timeout=
    [USB] Specifies timeout for the initial 64-byte USB_REQ_GET_DESCRIPTOR request in milliseconds
    (default 5000 = 5.0 seconds).

USBhid.mousepoll=
    [USBHID] The interval which mice are to be polled at.

USB-storage.delay_use=
    [UMS] The delay in seconds before a new device is scanned for Logical Units (default 5).

USB-storage.quirks=
    [UMS] A list of quirks entries to supplement or override the built-in unusual_devs list. List entries
    are separated by commas. Each entry has the form VID:PID:Flags where VID and PID are Vendor
    and Product ID values (4-digit hex numbers) and Flags is a set of characters, each corresponding
    to a common USB-storage quirk flag as follows:
    a = SANE_SENSE (collect more than 18 bytes of sense data);
    b = BAD_SENSE (don't collect more than 18 bytes of sense data);
    c = FIX_CAPACITY (decrease the reported device capacity by one sector);
    h = CAPACITY_HEURISTICS (decrease the reported device capacity by one sector if the number is odd);
    i = IGNORE_DEVICE (don't bind to this device);
    l = NOT_LOCKABLE (don't try to lock and unlock ejectable media);
    m = MAX_SECTORS_64 (don't transfer more than 64 sectors = 32 KB at a time);
    o = CAPACITY_OK (accept the capacity reported by the device);
    r = IGNORE_RESIDUE (the device reports
bogus residue values);  
\[ \text{Example: quirks=0419:aaf5:rl,0421:0433:rc} \]

userpte=  
\[ \text{[X86] Flags controlling user PTE allocations.} \]

\text{nohigh = do not allocate PTE pages in HIGHMEM regardless of setting of CONFIG_HIGHPTE.}  

\text{vdso=[X86,SH]}  
\text{vdso=2: enable compat VDSO (default with COMPAT_VDSO)}  
\text{vdso=1: enable VDSO (default)}  
\text{vdso=0: disable VDSO mapping}  

\text{vdso32=[X86]}  
\text{vdso32=2: enable compat VDSO (default with COMPAT_VDSO)}  
\text{vdso32=1: enable 32-bit VDSO (default)}  
\text{vdso32=0: disable 32-bit VDSO mapping}  

\text{vector=[IA-64,SMP]}  
\text{vector=percpu: enable percpu vector domain}  

\text{video=[FB] Frame buffer configuration}  
\text{See Documentation/fb/modedb.txt.}  

\text{vga=[BOOT.X86-32] Select a particular video mode}  
\text{See Documentation/x86/boot.txt and Documentation/svga.txt.}  
\text{Use vga=ask for menu.}  
\text{This is actually a boot loader parameter; the value is passed to the kernel using a special protocol.}  

\text{vmalloc=nn[KMG]}  
\text{[KNL,BOOT] Forces the vmalloc area to have an exact size of <nn>. This can be used to increase the minimum size (128MB on x86). It can also be used to decrease the size and leave more room for directly mapped kernel RAM.}  

\text{vmhalt= [KNL,S390] Perform z/VM CP command after system halt.}
Format: <command>

vmpanic= [KNL,S390] Perform z/VM CP command after kernel panic.

Format: <command>

vmoff= [KNL,S390] Perform z/VM CP command after power off.

Format: <command>

vt.cur_default= [VT] Default cursor shape.

Format: 0xCCBBAA, where AA, BB, and CC are the same as the parameters of the <Esc>[?A;B;Cc escape sequence; see VGA-softcursor.txt. Default: 2 = underline.

vt.default_blu= [VT]

Format: <blue0>,<blue1>,<blue2>,...,<blue15>

Change the default blue palette of the console.

This is a 16-member array composed of values ranging from 0-255.

vt.default_grn= [VT]

Format: <green0>,<green1>,<green2>,...,<green15>

Change the default green palette of the console.

This is a 16-member array composed of values ranging from 0-255.

vt.default_red= [VT]

Format: <red0>,<red1>,<red2>,...,<red15>

Change the default red palette of the console.

This is a 16-member array composed of values ranging from 0-255.

vt.default_utf8= [VT]

Format=<011>

Set system-wide default UTF-8 mode for all tty's. Default is 1, i.e. UTF-8 mode is enabled for all newly opened terminals.

vt.global_cursor_default= [VT]

Format=<-1011>

Set system-wide default for whether a cursor is shown on new VTs. Default is -1, i.e. cursors will be created by default unless overridden by individual drivers. 0 will hide
 cursors, 1 will display them.

waveartist= [HW,OSS]
Format: <io>,<irq>,<dma>,<dma2>

wd33c93= [HW,SCSI]
See header of drivers/scsi/wd33c93.c.

wd7000= [HW,SCSI]
See header of drivers/scsi/wd7000.c.

watchdog timers [HW,WDT] For information on watchdog timers,
see Documentation/watchdog/watchdog-parameters.txt or other driver-specific files in the Documentation/watchdog/ directory.

x2apic_phys [X86-64,APIC] Use x2apic physical mode instead of default x2apic cluster mode on platforms supporting x2apic.

x86_mrst_timer= [X86-32,APB]
Choose timer option for x86 Moorestown MID platform.

Two valid options are apbt timer only and lapic timer plus one apbt timer for broadcast timer.
x86_mrst_timer=apbt_only | lapic_and_apbt

xd= [HW,XT] Original XT pre-IDE (RLL encoded) disks.
x_geo= See header of drivers/block/xd.c.

xirc2ps_cs= [NET,PCMCIA]
Format:

<irq>,<irq_mask>,<io>,<full_duplex>,<do_sound>,<lockup_hack>[,<irq2>[,<irq3>[,<irq4>]]]
APPENDICE 2 – MAN PAGE

Mount

Name
mount - mount a file system

Synopsis
mount [-lhV]
mount -a [-fFnrsvw] [-t vfstype] [-O optlist]
mount [-fnrsvw] [-o options [,...]] device dir
mount [-fnrsvw] [-t vfstype] [-o options] device dir

Description
All files accessible in a Unix system are arranged in one big tree, the file hierarchy, rooted at /. These files can be spread out over several devices. The mount command serves to attach the file system found on some device to the big file tree. Conversely, the umount(8) command will detach it again.

The standard form of the mount command is

```
mount -t type device dir
```

This tells the kernel to attach the file system found on device (which is of type type) at the directory dir. The previous contents (if any) and owner and mode of dir become invisible, and as long as this file system remains mounted, the pathname dir refers to the root of the file system on device.

Three forms of invocation do not actually mount anything:

```
mount -h
```

prints a help message;

```
mount -V
```

prints a version string; and just

```
mount [-l] [-t type]
```
lists all mounted file systems (of type type). The option -l adds the (ext2, ext3 and XFS) labels in this listing. See below.

Since Linux 2.4.0 it is possible to remount part of the file hierarchy somewhere else. The call is

```
mount --bind olddir newdir
```

After this call the same contents is accessible in two places. One can also remount a single file (on a single file).

This call attaches only (part of) a single filesystem, not possible submounts. The entire file hierarchy including submounts is attached a second place using
mount --rbind olddir newdir

Note that the filesystem mount options will remain the same as those on the original mount point, and cannot be changed by passing the -o option along with --bind/--rbind.

Since Linux 2.5.1 it is possible to atomically move a mounted tree to another place. The call is

mount --move olddir newdir

Since Linux 2.6.15 it is possible to mark a mount and its submounts as shared, private, slave or unbindable. A shared mount provides ability to create mirrors of that mount such that mounts and umounts within any of the mirrors propagate to the other mirror. A slave mount receives propagation from its master, but any not vice-versa. A private mount carries no propagation abilities. A unbindable mount is a private mount which cannot cloned through a bind operation. Detailed semantics is documented in Documentation/sharedsubtree.txt file in the kernel source tree.

mount --make-shared mountpoint
mount --make-slave mountpoint
mount --make-private mountpoint
mount --make-unbindable mountpoint

The following commands allows one to recursively change the type of all the mounts under a given mountpoint.

mount --make-rshared mountpoint
mount --make-rslave mountpoint
mount --make-rprivate mountpoint
"mount --make-runbindable mountpoint"

The proc file system is not associated with a special device, and when mounting it, an arbitrary keyword, such as proc can be used instead of a device specification. (The customary choice none is less fortunate: the error message 'none busy' from umount can be confusing.)

Most devices are indicated by a file name (of a block special device), like /dev/sda1, but there are other possibilities. For example, in the case of an NFS mount, device may look like knuth.cwi.nl:/dir. It is possible to indicate a block special device using its volume label or UUID (see the -L and -U options below).

The file /etc/fstab (see fstab(5)), may contain lines describing what devices are usually mounted where, using which options. This file is used in three ways:

(i) The command
mount -a [-t type] [-O optlist]

(usually given in a bootscript) causes all file systems mentioned in fstab (of the proper type and/or having or not having the proper options) to be mounted as indicated, except for those whose line contains the noauto keyword. Adding the -F option will make mount fork, so that the filesystems are mounted simultaneously.

(ii) When mounting a file system mentioned in fstab, it suffices to give only the device, or only the mount point.

(iii) Normally, only the superuser can mount file systems. However, when fstab contains the user option on a line, anybody can mount the corresponding system.

Thus, given a line

/dev/cdrom /cd iso9660 ro,user,noauto,unhide

any user can mount the iso9660 file system found on his CDROM using the command

    mount /dev/cdrom

or

    mount /cd

For more details, see fstab(5). Only the user that mounted a filesystem can unmount it again. If any user should be able to unmount, then use users instead of user in the fstab line. The owner option is similar to the user option, with the restriction that the user must be the owner of the special file. This may be useful e.g. for /dev/fd if a login script makes the console user owner of this device. The group option is similar, with the restriction that the user must be member of the group of the special file.

The programs mount and umount maintain a list of currently mounted file systems in the file /etc/mtab. If no arguments are given to mount, this list is printed.

When the proc filesystem is mounted (say at /proc), the files /etc/mtab and /proc/mounts have very similar contents. The former has somewhat more information, such as the mount options used, but is not necessarily up-to-date (cf. the -n option below). It is possible to replace /etc/mtab by a symbolic link to /proc/mounts, and especially when you have very large numbers of mounts things will be much faster with that symlink, but some information is lost that way, and in particular working with the loop device will be less convenient, and using the "user" option will fail.

Options
The full set of options used by an invocation of mount is determined by first extracting the options for the file system from the fstab table, then applying any
options specified by the -o argument, and finally applying a -r or -w option, when present.

Options available for the mount command:

- V
  Output version.
-h
  Print a help message.
-v
  Verbose mode.
-a
  Mount all filesystems (of the given types) mentioned in fstab.
-F
  (Used in conjunction with -a.) Fork off a new incarnation of mount for each
device. This will do the mounts on different devices or different NFS servers in
parallel. This has the advantage that it is faster; also NFS timeouts go in parallel. A
disadvantage is that the mounts are done in undefined order. Thus, you cannot use
this option if you want to mount both /usr and /usr/spool.
-f
  Causes everything to be done except for the actual system call; if it's not obvious,
this "fakes" mounting the file system. This option is useful in conjunction with the -v
flag to determine what the mount command is trying to do. It can also be used to add
entries for devices that were mounted earlier with the -n option.
-i
  Don't call the /sbin/mount.<filesystem> helper even if it exists.
-l
  Add the ext2, ext3 and XFS labels in the mount output. Mount must have
  permission to read the disk device (e.g. be suid root) for this to work. One can set
  such a label for ext2 or ext3 using the e2label(8) utility, or for XFS using
  xfs_admin(8), or for reiserfs using reiserfstune(8).
-n
  Mount without writing in /etc/mtab. This is necessary for example when /etc is on
  a read-only file system.
-pnum
  In case of a loop mount with encryption, read the passphrase from file descriptor
  num instead of from the terminal.
-s
  Tolerate sloppy mount options rather than failing. This will ignore mount options
  not supported by a filesystem type. Not all filesystems support this option. This
  option exists for support of the Linux automounter.
-r
  Mount the filesystem read-only. A synonym is -o ro.
-w
  Mount the file system read/write. This is the default. A synonym is -o rw.
-L label
  Mount the partition that has the specified label.
-U uuid
Mount the partition that has the specified uuid. These two options require the file /proc/partitions (present since Linux 2.1.116) to exist.

-t vsfype

The argument following the -t is used to indicate the file system type. The file system types which are currently supported include: adfs, afs, autofs, cifs, coda, coherent, cramfs, debugfs, devpts, efs, ext, ext2, ext3, hfs, hpf, iso9660, jfs, minix, msdos, ncpfs, nfs, nfs4, ntfs, proc, qnx4, ramfs, reiserfs, romfs, smbfs, sysv, tmpfs, udf, ufs, umsdos, USBfs, vfat, xenix, xfs, xiafs. Note that coherent, sysv and xenix are equivalent and that xenix and coherent will be removed at some point in the future -- use sysv instead. Since kernel version 2.1.21 the types ext and xiafs do not exist anymore. Earlier, USBfs was known as USBdevfs.

For most types all the mount program has to do is issue a simple mount(2) system call, and no detailed knowledge of the filesystem type is required. For a few types however (like nfs, nfs4, cifs, smbfs, ncpfs) ad hoc code is necessary. The nfs ad hoc code is built in, but cifs, smbfs, and ncpfs have a separate mount program. In order to make it possible to treat all types in a uniform way, mount will execute the program /sbin/mount.TYPE (if that exists) when called with type TYPE. Since various versions of the smbmount program have different calling conventions, /sbin/mount.smbfs may have to be a shell script that sets up the desired call.

If no -t option is given, or if the auto type is specified, mount will try to guess the desired type. If mount was compiled with the blkid library, the guessing is done by this library. Otherwise, mount guesses itself by probing the superblock; if that does not turn up anything that looks familiar, mount will try to read the file /etc/filesystems, or, if that does not exist, /proc/filesystems. All of the filesystem types listed there will be tried, except for those that are labeled "nodev" (e.g., devpts, proc, nfs, and nfs4). If /etc/filesystems ends in a line with a single * only, mount will read /proc/filesystems afterwards.

The auto type may be useful for user-mounted floppies. Creating a file /etc/filesystems can be useful to change the probe order (e.g., to try vfat before msdos or ext3 before ext2) or if you use a kernel module autoloader. Warning: the probing uses a heuristic (the presence of appropriate 'magic'), and could recognize the wrong filesystem type, possibly with catastrophic consequences. If your data is valuable, don't ask mount to guess.

More than one type may be specified in a comma separated list. The list of file system types can be prefixed with no to specify the file system types on which no action should be taken. (This can be meaningful with the -a option.)

For example, the command:
mount -a -t nomsdos,ext mounts all file systems except those of type msdos and ext.

-O

Used in conjunction with -a, to limit the set of filesystems to which the -a is applied. Like -t in this regard except that it is useless except in the context of -a. For example, the command:
mount -a -O no_netdev mounts all file systems except those which have the option _netdev specified in the options field in the /etc/fstab file.
It is different from -t in that each option is matched exactly; a leading no at the beginning of one option does not negate the rest.

The -t and -O options are cumulative in effect; that is, the command

```
mount -a -t ext2 -O _netdev
```

mounts all ext2 filesystems with the _netdev option, not all filesystems that are either ext2 or have the _netdev option specified.

-o  
Options are specified with a -o flag followed by a comma separated string of options. Some of these options are only useful when they appear in the /etc/fstab file. The following options apply to any file system that is being mounted (but not every file system actually honors them - e.g., the sync option today has effect only for ext2, ext3, fat, vfat and ufs):

async  
All I/O to the file system should be done asynchronously.

atime  
Update inode access time for each access. This is the default.

auto  
Can be mounted with the -a option.

defaults  
Use default options: rw, suid, dev, exec, auto, nouser, and async.

dev  
Interpret character or block special devices on the file system.

exec  
Permit execution of binaries.

group  
Allow an ordinary (i.e., non-root) user to mount the file system if one of his groups matches the group of the device. This option implies the options nosuid and nodev (unless overridden by subsequent options, as in the option line group,dev,suid).

mand  
Allow mandatory locks on this filesystem. See fcntl(2).

_netdev  
The filesystem resides on a device that requires network access (used to prevent the system from attempting to mount these filesystems until the network has been enabled on the system).

noatime  
Do not update inode access times on this file system (e.g, for faster access on the news spool to speed up news servers).

nodiratime  
Do not update directory inode access times on this filesystem.

noauto  
Can only be mounted explicitly (i.e., the -a option will not cause the file system to be mounted).

nodev
Do not interpret character or block special devices on the file system.

noexec

Do not allow direct execution of any binaries on the mounted file system. (Until recently it was possible to run binaries anyway using a command like /lib/ld*.so /mnt/binary. This trick fails since Linux 2.4.25 / 2.6.0.)

nomand

Do not allow mandatory locks on this filesystem.

nosuid

Do not allow set-user-identifier or set-group-identifier bits to take effect. (This seems safe, but is in fact rather unsafe if you have suidper(1) installed.)

nouser

Forbid an ordinary (i.e., non-root) user to mount the file system. This is the default.

owner

Allow an ordinary (i.e., non-root) user to mount the file system if he is the owner of the device. This option implies the options nosuid and nodev (unless overridden by subsequent options, as in the option line owner,dev,suid).

remount

Attempt to remount an already-mounted file system. This is commonly used to change the mount flags for a file system, especially to make a readonly file system writeable. It does not change device or mount point.

ro

Mount the file system read-only.

rw

Mount the file system read-write.

suid

Allow set-user-identifier or set-group-identifier bits to take effect.

sync

All I/O to the file system should be done synchronously. In case of media with limited number of write cycles (e.g. some flash drives) "sync" may cause life-cycle shortening.

dirsync

All directory updates within the file system should be done synchronously. This affects the following system calls: creat, link, unlink, symlink, mkdir, rmdir, mknode and rename.

user

Allow an ordinary user to mount the file system. The name of the mounting user is written to mtab so that he can unmount the file system again. This option implies the options noexec, nosuid, and nodev (unless overridden by subsequent options, as in the option line user,exec,dev,suid).

users

Allow every user to mount and unmount the file system. This option implies the options noexec, nosuid, and nodev (unless overridden by subsequent options, as in the option line users,exec,dev,suid).

context=, fscontext=, context and defcontext=,context

The context= option is useful when mounting filesystems that do not support extended attributes, such as a floppy or hard disk formatted with VFAT, or systems that are not normally running under SELinux, such as an ext3 formatted disk from a
non-SELinux workstation. You can also use context= on filesystems you do not trust, such as a floppy. It also helps in compatibility with xattr-supporting filesystems on earlier 2.4.<cx> kernel versions. Even where xattrs are supported, you can save time not having to label every file by assigning the entire disk one security context.

A commonly used option for removable media is context=system_u:object_r:removable_t.

Two other options are fscontext= and defcontext=, both of which are mutually exclusive of the context option. This means you can use fscontext and defcontext with each other, but neither can be used with context.

The fscontext= option works for all filesystems, regardless of their xattr support. The fscontext option sets the overarching filesystem label to a specific security context. This filesystem label is separate from the individual labels on the files. It represents the entire filesystem for certain kinds of permission checks, such as during mount or file creation. Individual file labels are still obtained from the xattrs on the files themselves. The context option actually sets the aggregate context that fscontext provides, in addition to supplying the same label for individual files.

You can set the default security context for unlabeled files using defcontext= option. This overrides the value set for unlabeled files in the policy and requires a file system that supports xattr labeling.

For more details see selinux(8)

--bind
Remount a subtree somewhere else (so that its contents are available in both places). See above.

--move
Move a subtree to some other place; See above.

Filesystem Specific Mount Options
The following options apply only to certain file systems. We sort them by file system. They all follow the -o flag.

What options are supported depends a bit on the running kernel. More info may be found in the kernel source subdirectory Documentation/filesystems.

Mount options for adfs

uid=value and gid=value
Set the owner and group of the files in the file system (default: uid=gid=0).

ownmask=value and othmask=value
Set the permission mask for ADFS 'owner' permissions and 'other' permissions, respectively (default: 0700 and 0077, respectively). See also /usr/src/linux/Documentation/filesystems/adfs.txt.

Mount options for affs
uid=value and gid=value
   Set the owner and group of the root of the file system (default: uid=gid=0, but with option uid or gid without specified value, the uid and gid of the current process are taken).

setuid=value and setgid=value
   Set the owner and group of all files.

mode=value
   Set the mode of all files to value & 0777 disregarding the original permissions.

Add search permission to directories that have read permission. The value is given in octal.

protect
   Do not allow any changes to the protection bits on the file system.

usemp
   Set uid and gid of the root of the file system to the uid and gid of the mount point upon the first sync or umount, and then clear this option. Strange...

verbose
   Print an informational message for each successful mount.

prefix=string
   Prefix used before volume name, when following a link.

volume=string
   Prefix (of length at most 30) used before ‘/’ when following a symbolic link.

reserved=value
   (Default: 2.) Number of unused blocks at the start of the device.

root=value
   Give explicitly the location of the root block.

bs=value
   Give blocksize. Allowed values are 512, 1024, 2048, 4096.

grpquota / noquota / quota / usrquota
   These options are accepted but ignored. (However, quota utilities may react to such strings in /etc/fstab.)

**Mount options for cifs**
See the options section of the mount.cifs(8) man page (cifs-mount package must be installed).

**Mount options for cifs**
Just like nfs or smbfs implementation expects a binary argument to the mount system call. This argument is constructed by mount.cifs(8) and the current version of mount (2.12) does not know anything about cifs.

**Mount options for coherent**
None.

**Mount options for devpts**
The devpts file system is a pseudo file system, traditionally mounted on /sys/kernel/debug. There are no mount options.

**Mount options for devpts**
The devpts file system is a pseudo file system, traditionally mounted on /dev/pts. In order to acquire a pseudo terminal, a process opens /dev/ptmx; the number of the pseudo terminal is then made available to the process and the pseudo terminal slave can be accessed as /dev/pts/<number>.
uid=value and gid=value

This sets the owner or the group of newly created PTYs to the specified values. When nothing is specified, they will be set to the UID and GID of the creating process. For example, if there is a tty group with GID 5, then gid=5 will cause newly created PTYs to belong to the tty group.

mode=value

Set the mode of newly created PTYs to the specified value. The default is 0600. A value of mode=620 and gid=5 makes "mesg y" the default on newly created PTYs.

Mount options for ext

None. Note that the 'ext' file system is obsolete. Don't use it. Since Linux version 2.1.21 extfs is no longer part of the kernel source.

Mount options for ext2

The 'ext2' file system is the standard Linux file system. Since Linux 2.5.46, for most mount options the default is determined by the filesystem superblock. Set them with tune2fs(8).

acl / noacl

Support POSIX Access Control Lists (or not).

bsdff / minixdf

Set the behaviour for the statfs system call. The minixdf behaviour is to return in the f_blocks field the total number of blocks of the file system, while the bsdff behaviour (which is the default) is to subtract the overhead blocks used by the ext2 file system and not available for file storage.

Thus

% mount /k -o minixdf; df /k; umount /k
Filesystem 1024-blocks Used Available Capacity Mounted on
/dev/sda6 2630655 86954 2412169 3% /k
% mount /k -o bsdff; df /k; umount /k
Filesystem 1024-blocks Used Available Capacity Mounted on
/dev/sda6 2543714 13 2412169 0% /k

(Note that this example shows that one can add command line options to the options given in /etc/fstab.)

check=none / nocheck

No checking is done at mount time. This is the default. This is fast. It is wise to invoke e2fsck(8) every now and then, e.g. at boot time.

debug

Print debugging info upon each (re)mount.

errors=continue / errors=remount-ro / errors=panic

Define the behaviour when an error is encountered. (Either ignore errors and just mark the file system erroneous and continue, or remount the file system read-only, or panic and halt the system.) The default is set in the filesystem superblock, and can be changed using tune2fs(8).

grpdr or bsdgroups / nogrpdr or sysvgroups
These options define what group id a newly created file gets. When grpid is set, it takes the group id of the directory in which it is created; otherwise (the default) it takes the fsgid of the current process, unless the directory has the setgid bit set, in which case it takes the gid from the parent directory, and also gets the setgid bit set if it is a directory itself.
grpquota / noquota / quota / usrquota

These options are accepted but ignored.
nobh

Do not attach buffer_heads to file pagecache. (Since 2.5.49.)
nouid32

Disables 32-bit UIDs and GIDs. This is for interoperability with older kernels which only store and expect 16-bit values.
oldalloc or orlov

Use old allocator or Orlov allocator for new inodes. Orlov is default.
resgid=n and resuid=n

The ext2 file system reserves a certain percentage of the available space (by default 5%, see mke2fs(8) and tune2fs(8)). These options determine who can use the reserved blocks. (Roughly: whoever has the specified uid, or belongs to the specified group.)
sb=n

Instead of block 1, use block n as superblock. This could be useful when the filesystem has been damaged. (Earlier, copies of the superblock would be made every 8192 blocks: in block 1, 8193, 16385, ... (and one got thousands of copies on a big filesystem). Since version 1.08, mke2fs has a -s (sparse superblock) option to reduce the number of backup superblocks, and since version 1.15 this is the default. Note that this may mean that ext2 filesystems created by a recent mke2fs cannot be mounted r/w under Linux 2.0. *) The block number here uses 1k units. Thus, if you want to use logical block 32768 on a filesystem with 4k blocks, use "sb=131072".
user_xattr / nouser_xattr

Support "user." extended attributes (or not).

Mount options for ext3

The 'ext3' file system is a version of the ext2 file system which has been enhanced with journaling. It supports the same options as ext2 as well as the following additions:

journal=update

Update the ext3 file system's journal to the current format.
journal=inum

When a journal already exists, this option is ignored. Otherwise, it specifies the number of the inode which will represent the ext3 file system's journal file; ext3 will create a new journal, overwriting the old contents of the file whose inode number is inum.
noload

Do not load the ext3 file system's journal on mounting.
data=journal / data=ordered / data=writeback
Specifies the journalling mode for file data. Metadata is always journaled. To use modes other than ordered on the root file system, pass the mode to the kernel as boot parameter, e.g. rootflags=data=journal.

ordered
All data is committed into the journal prior to being written into the main file system.

writeback
_data ordering is not preserved - data may be written into the main file system after its metadata has been committed to the journal. This is rumoured to be the highest-throughput option. It guarantees internal file system integrity, however it can allow old data to appear in files after a crash and journal recovery.

commit=nrsec
Sync all data and metadata every nrsec seconds. The default value is 5 seconds. Zero means default.

**Mount options for fat**
(Note: fat is not a separate filesystem, but a common part of the msdos, umsdos and vfat filesystems.)

blocksize=512 / blocksize=1024 / blocksize=2048
  Set blocksize (default 512).
uid=value and gid=value
  Set the owner and group of all files. (Default: the uid and gid of the current process.)
umask=value
  Set the umask (the bitmask of the permissions that are not present). The default is the umask of the current process. The value is given in octal.

dmask=value
  Set the umask applied to directories only. The default is the umask of the current process. The value is given in octal.
fmask=value
  Set the umask applied to regular files only. The default is the umask of the current process. The value is given in octal.
check=value
  Three different levels of pickyness can be chosen: r(elaxed)
  Upper and lower case are accepted and equivalent, long name parts are truncated (e.g. verylongname.foobar becomes verylong.foo), leading and embedded spaces are accepted in each name part (name and extension).
n(ormal)
  Like "relaxed", but many special characters (*, ?, <, spaces, etc.) are rejected. This is the default.
s(trict)
Like "normal", but names may not contain long parts and special characters that are sometimes used on Linux, but are not accepted by MS-DOS are rejected. (+, =, spaces, etc.)
codepage=value
Sets the codepage for converting to shortname characters on FAT and VFAT filesystems. By default, codepage 437 is used.
conv=b[inary] / conv=t[ext] / conv=a[uto]
The fat file system can perform CRLF<-->NL (MS-DOS text format to UNIX text format) conversion in the kernel. The following conversion modes are available:
binary
no translation is performed. This is the default.
text
CRLF<-->NL translation is performed on all files.
auto
CRLF<-->NL translation is performed on all files that don't have a "well-known binary" extension. The list of known extensions can be found at the beginning of fs/fat/misc.c (as of 2.0, the list is: exe, com, bin, app, sys, drv, ovl, obj, lib, dll, pif, arc, zip, lha, lzh, zoo, tar, z, arj, tz, taz, tpz, gz, deb, gif, bmp, tif, gl, jpg, pcx, tifm, vf, gif, pk, pxl, dvi).

Programs that do computed seek won't like in-kernel text conversion. Several people have had their data ruined by this translation. Beware!
For file systems mounted in binary mode, a conversion tool (fromdos/todos) is available.

cvf_format=module
Forces the driver to use the CVF (Compressed Volume File) module cvf_module instead of auto-detection. If the kernel supports kmod, the cvf_format=xxx option also controls on-demand CVF module loading.
cvf_option=option
Option passed to the CVF module.
debug
Turn on the debug flag. A version string and a list of file system parameters will be printed (these data are also printed if the parameters appear to be inconsistent).
fat=12 / fat=16 / fat=32
Specify a 12, 16 or 32 bit fat. This overrides the automatic FAT type detection routine. Use with caution!
iocharset=value
Character set to use for converting between 8 bit characters and 16 bit Unicode characters. The default is iso8859-1. Long filenames are stored on disk in Unicode format.
quiet
Turn on the quiet flag. Attempts to chown or chmod files do not return errors, although they fail. Use with caution!
sys_immutable, showexec, dots, nodots, dotsOK=[yes|no]
Various misguided attempts to force Unix or DOS conventions onto a FAT file system.
Mount options for hfs

creator=cccc, type=cccc
Set the creator/type values as shown by the MacOS finder used for creating new files. Default values: '?????'.
uid=n, gid=n
Set the owner and group of all files. (Default: the uid and gid of the current process.)
dir_umask=n, file_umask=n, umask=n
Set the umask used for all directories, all regular files, or all files and directories. Defaults to the umask of the current process.
session=n
Select the CDROM session to mount. Defaults to leaving that decision to the CDROM driver. This option will fail with anything but a CDROM as underlying device.
part=n
Select partition number n from the device. Only makes sense for CDROMS. Defaults to not parsing the partition table at all.
quiet
Don't complain about invalid mount options.

Mount options for hpfs

uid=value and gid=value
Set the owner and group of all files. (Default: the uid and gid of the current process.)
umask=value
Set the umask (the bitmask of the permissions that are not present). The default is the umask of the current process. The value is given in octal.
case=lower / case=asis
Convert all file names to lower case, or leave them. (Default: case=lower.)
conv=binary / conv=text / conv=auto
For conv=text, delete some random CRs (in particular, all followed by NL) when reading a file. For conv=auto, choose more or less at random between conv=binary and conv=text. For conv=binary, just read what is in the file. This is the default.
nocheck
Do not abort mounting when certain consistency checks fail.

Mount options for iso9660

ISO 9660 is a standard describing a filesystem structure to be used on CD-ROMs. (This filesystem type is also seen on some DVDs. See also the udf filesystem.)

Normal iso9660 filenames appear in a 8.3 format (i.e., DOS-like restrictions on filename length), and in addition all characters are in upper case. Also there is no field for file ownership, protection, number of links, provision for block/character devices, etc.

Rock Ridge is an extension to iso9660 that provides all of these unix like features. Basically there are extensions to each directory record that supply all of the
additional information, and when Rock Ridge is in use, the filesystem is indistinguishable from a normal UNIX file system (except that it is read-only, of course).

no rock
  Disable the use of Rock Ridge extensions, even if available. Cf. map.

no joliet
  Disable the use of Microsoft Joliet extensions, even if available. Cf. map.

check=relaxed | check=strict
  With check=relaxed, a filename is first converted to lower case before doing the lookup. This is probably only meaningful together with norock and map=normal. (Default: check=strict.)

uid=value and gid=value
  Give all files in the file system the indicated user or group id, possibly overriding the information found in the Rock Ridge extensions. (Default: uid=0,gid=0.)

map=n[ormal] / map=o[ff] / map=a[corn]
  For non-Rock Ridge volumes, normal name translation maps upper to lower case ASCII, drops a trailing ‘;’, and converts ‘ ’ to ‘’. With map=off no name translation is done. See norock. (Default: map=normal.) map=acorn is like map=normal but also apply Acorn extensions if present.

mode=value
  For non-Rock Ridge volumes, give all files the indicated mode. (Default: read permission for everybody.) Since Linux 2.1.37 one no longer needs to specify the mode in decimal. (Octal is indicated by a leading 0.)

un hide
  Also show hidden and associated files. (If the ordinary files and the associated or hidden files have the same filenames, this may make the ordinary files inaccessible.)

block=[512|1024|2048]
  Set the block size to the indicated value. (Default: block=1024.)

conv=a[uto] / conv=b[inary] / conv=m[text] / conv=t[ext]
  (Default: conv=binary.) Since Linux 1.3.54 this option has no effect anymore. (And non-binary settings used to be very dangerous, possibly leading to silent data corruption.)

cr aft
  If the high byte of the file length contains other garbage, set this mount option to ignore the high order bits of the file length. This implies that a file cannot be larger than 16MB.

session=x
  Select number of session on multisession CD. (Since 2.3.4.)

sb sector=x x x
  Session begins from sector xxx. (Since 2.3.4.)

The following options are the same as for vfat and specifying them only makes sense when using discs encoded using Microsoft’s Joliet extensions.

io charset=value
  Character set to use for converting 16 bit Unicode characters on CD to 8 bit characters. The default is iso8859-1.

utf8
Convert 16 bit Unicode characters on CD to UTF-8.

Mount options for jfs

iocharset=name
    Character set to use for converting from Unicode to ASCII. The default is to do no conversion. Use iocharset=utf8 for UTF8 translations. This requires CONFIG_NLS_UTF8 to be set in the kernel .config file.
resize=value
    Resize the volume to value blocks. JFS only supports growing a volume, not shrinking it. This option is only valid during a remount, when the volume is mounted read-write. The resize keyword with no value will grow the volume to the full size of the partition.
nointegrity
    Do not write to the journal. The primary use of this option is to allow for higher performance when restoring a volume from backup media. The integrity of the volume is not guaranteed if the system abnormally abends.
integrity
    Default. Commit metadata changes to the journal. Use this option to remount a volume where the nointegrity option was previously specified in order to restore normal behavior.
errors=continue / errors=remount-ro / errors=panic
    Define the behaviour when an error is encountered. (Either ignore errors and just mark the file system erroneous and continue, or remount the file system read-only, or panic and halt the system.)
noquota / quota / usrquota / grpquota
    These options are accepted but ignored.

Mount options for minix

None.

Mount options for msdos

See mount options for fat. If the msdos file system detects an inconsistency, it reports an error and sets the file system read-only. The file system can be made writeable again by remounting it.

Mount options for ncpfs

Just like nfs, the ncpfs implementation expects a binary argument (a struct ncp_mount_data) to the mount system call. This argument is constructed by ncpmount(8) and the current version of mount (2.12) does not know anything about ncpfs.

Mount options for nfs

Instead of a textual option string, parsed by the kernel, the nfs file system expects a binary argument of type struct nfs_mount_data. The program mount itself parses the following options of the form 'tag=value', and puts them in the structure mentioned: rsize=n, wsize=n, timeo=n, retrans=n, acгрemin=n, acгрemax=n, acdirmin=n, acdirmax=n, actimeo=n, retry=n, port=n, mountport=n, mounthost=name, mountprog=n, mountvers=n, nfsprog=n, nfsvers=n, namlen=n. The option addr=n is accepted but ignored. Also the following Boolean options, possibly preceded by no
are recognized: bg, fg, soft, hard, intr, posix, cto, ac, tcp, udp, lock. For details, see nfs(5).

Especially useful options include

rsz=32768,wsz=32768

This causes the NFS client to try to negotiate a buffer size up to the size specified. A large buffer size does improve performance, but both the server and client have to support it. In the case where one of these does not support the size specified, the size negotiated will be the largest that both support.

intr

This will allow NFS operations (on hard mounts) to be interrupted while waiting for a response from the server.

nolock

Do not use locking. Do not start lockd.

Mount options for nfs4

Instead of a textual option string, parsed by the kernel, the nfs4 file system expects a binary argument of type struct nfs4_mount_data. The program mount itself parses the following options of the form 'tag=value', and puts them in the structure mentioned: rsize=n, wsize=n, timo=n, retrans=n, acregmin=n, acregmax=n, acdirmin=n, acdirmax=n, actimeo=n, retry=n, port=n, proto=n, clientaddr=n, sec=n. The option addr=n is accepted but ignored. Also the following Boolean options, possibly preceded by no are recognized: bg, fg, soft, hard, intr, cto, ac. For details, see nfs(5).

Especially useful options include

rsz=32768,wsz=32768

This causes the NFS4 client to try to negotiate a buffer size up to the size specified. A large buffer size does improve performance, but both the server and client have to support it. In the case where one of these does not support the size specified, the size negotiated will be the largest that both support.

intr

This will allow NFS4 operations (on hard mounts) to be interrupted while waiting for a response from the server.

Mount options for ntfs

iocharset=name

Character set to use when returning file names. Unlike VFAT, NTFS suppresses names that contain unconvertible characters. Deprecated.

nls=name

New name for the option earlier called iocharset.

utf8

Use UTF-8 for converting file names.

uni_xlate=[0112]
For 0 (or 'no' or 'false'), do not use escape sequences for unknown Unicode characters. For 1 (or 'yes' or 'true') or 2, use vfat-style 4-byte escape sequences starting with ":". Here 2 give a little-endian encoding and 1 a byteswapped bigendian encoding.

posix=[0]1

If enabled (posix=1), the file system distinguishes between upper and lower case.
The 8.3 alias names are presented as hard links instead of being suppressed.
uid=value, gid=value and umask=value

Set the file permission on the filesystem. The umask value is given in octal. By default, the files are owned by root and not readable by somebody else.

**Mount options for proc**

uid=value and gid=value

These options are recognized, but have no effect as far as I can see.

**Mount options for ramfs**

Ramfs is a memory based filesystem. Mount it and you have it. Unmount it and it is gone. Present since Linux 2.3.99pre4. There are no mount options.

Mount options for reiserfs

Reiserfs is a journaling filesystem. The reiserfs mount options are more fully described at http://www.namesys.com/mount-options.html.

conv

Instructs version 3.6 reiserfs software to mount a version 3.5 file system, using the 3.6 format for newly created objects. This file system will no longer be compatible with reiserfs 3.5 tools.

hash=rupasov / hash=tea / hash=r5 / hash=detect

Choose which hash function reiserfs will use to find files within directories.

rupasov

A hash invented by Yury Yu. Rupasov. It is fast and preserves locality, mapping lexicographically close file names to close hash values. This option should not be used, as it causes a high probability of hash collisions.

tea

A Davis-Meyer function implemented by Jeremy Fitzhardinge. It uses hash permuting bits in the name. It gets high randomness and, therefore, low probability of hash collisions at some CPU cost. This may be used if EHASHCOLLISION errors are experienced with the r5 hash.

r5

A modified version of the rupasov hash. It is used by default and is the best choice unless the file system has huge directories and unusual file-name patterns.

detect

Instructs mount to detect which hash function is in use by examining the file system being mounted, and to write this information into the reiserfs superblock. This is only useful on the first mount of an old format file system.

hashed_relocation

Tunes the block allocator. This may provide performance improvements in some situations.
no_unhashed_relocation
   Tunes the block allocator. This may provide performance improvements in some situations.

noborder
   Disable the border allocator algorithm invented by Yury Yu. Rupasov. This may provide performance improvements in some situations.

nolog
   Disable journalling. This will provide slight performance improvements in some situations at the cost of losing reiserfs’s fast recovery from crashes. Even with this option turned on, reiserfs still performs all journalling operations, save for actual writes into its journalling area. Implementation of nolog is a work in progress.

notail
   By default, reiserfs stores small files and ‘file tails’ directly into its tree. This confuses some utilities such as lilo(8). This option is used to disable packing of files into the tree.

replayonly
   Replay the transactions which are in the journal, but do not actually mount the file system. Mainly used by reiserfsck.

resize=number
   A remount option which permits online expansion of reiserfs partitions. Instructs reiserfs to assume that the device has number blocks. This option is designed for use with devices which are under logical volume management (LVM). There is a special resizer utility which can be obtained from ftp://ftp.namesys.com/pub/reiserfsprogs.

Mount options for romfs
None.

Mount options for smbfs
Just like nfs, the smbfs implementation expects a binary argument (a struct smb_mount_data) to the mount system call. This argument is constructed by smbmount(8) and the current version of mount (2.12) does not know anything about smbfs.

Mount options for sysv
None.

Mount options for tmpfs
The following parameters accept a suffix k, m or g for Ki, Mi, Gi (binary kilo, mega and giga) and can be changed on remount.

size= nbytes
   Override default maximum size of the filesystem. The size is given in bytes, and rounded down to entire pages. The default is half of the memory.

nr_blocks=
   Set number of blocks.

nr_inodes=
   Set number of inodes.

mode=
   Set initial permissions of the root directory.

Mount options for udf
udf is the "Universal Disk Format" filesystem defined by the Optical Storage Technology Association, and is often used for DVD-ROM. See also iso9660.

gid=
    Set the default group.
umask=
    Set the default umask. The value is given in octal.
uid=
    Set the default user.
unhide
    Show otherwise hidden files.
undelete
    Show deleted files in lists.
nostrict
    Unset strict conformance.
iocharset
    Set the NLS character set.
bs=
    Set the block size. (May not work unless 2048.)
novrs
    Skip volume sequence recognition.
session=
    Set the CDROM session counting from 0. Default: last session.
anchor=
    Override standard anchor location. Default: 256.
volume=
    Override the VolumeDesc location. (unused)
partition=
    Override the PartitionDesc location. (unused)
lastblock=
    Set the last block of the filesystem.
filesset=
    Override the filesset block location. (unused)
rootdir=
    Override the root directory location. (unused)

Mount options for ufs

ufstype=value
    UFS is a file system widely used in different operating systems. The problem are
differences among implementations. Features of some implementations are
undocumented, so its hard to recognize the type of ufs automatically. That's why the
user must specify the type of ufs by mount option. Possible values are:
old
    Old format of ufs, this is the default, read only. (Don't forget to give the -r option.)
44bsd
    For filesystems created by a BSD-like system (NetBSD,FreeBSD,OpenBSD).
sun
For filesystems created by SunOS or Solaris on Sparc.

sunx86
  For filesystems created by Solaris on x86.

hp
  For filesystems created by HP-UX, read-only.

nextstep
  For filesystems created by NeXTStep (on NeXT station) (currently read only).

nextstep-cd
  For NextStep CDROMs (block_size == 2048), read-only.

openstep
  For filesystems created by OpenStep (currently read only). The same filesystem
type is also used by Mac OS X.

onerror=\texttt{value}
  Set behaviour on error:
  \begin{itemize}
    \item \texttt{panic}
      \begin{itemize}
        \item If an error is encountered, cause a kernel panic.
      \end{itemize}
  \end{itemize}

\begin{itemize}
  \item \texttt{[lockumount\texttt{repair}]}
  \end{itemize}

These mount options don't do anything at present; when an error is encountered
only a console message is printed.

\textbf{Mount options for umsdos}  
See mount options for msdos. The dotsOK option is explicitly killed by umsdos.

\begin{itemize}
  \item \texttt{Mount options for vfat}
  \begin{itemize}
    \item First of all, the mount options for fat are recognized. The dotsOK option is explicitly
    killed by vfat. Furthermore, there are
  \end{itemize}
\end{itemize}

\begin{itemize}
  \item \texttt{uni\_xlate}
    \begin{itemize}
      \item Translate unhandled Unicode characters to special escaped sequences. This lets
      you backup and restore filenames that are created with any Unicode characters.
      \begin{itemize}
        \item Without this option, a '?' is used when no translation is possible. The escape character
        is ':' because it is otherwise illegal on the vfat filesystem. The escape sequence that
        gets used, where \texttt{u} is the unicode character, is: ':', (\texttt{u} \& \texttt{0x3f}), ((\texttt{u}>>6) \& \texttt{0x3f}),
        ((\texttt{u}>>12).
      \end{itemize}
    \end{itemize}
  \end{itemize}

\begin{itemize}
  \item \texttt{posix}
    \begin{itemize}
      \item Allow two files with names that only differ in case.
      \end{itemize}
  \end{itemize}

\begin{itemize}
  \item \texttt{nonumtail}
    \begin{itemize}
      \item First try to make a short name without sequence number, before trying
      name=\texttt{num.ext}.
      \end{itemize}
  \end{itemize}

\begin{itemize}
  \item \texttt{utf8}
    \begin{itemize}
      \item UTF8 is the filesystem safe 8-bit encoding of Unicode that is used by the console.
      It can be be enabled for the filesystem with this option. If 'uni\_xlate' gets set, UTF8
      gets disabled.
      \end{itemize}
\end{itemize}

\begin{itemize}
  \item \texttt{shortname=[lower\texttt{\textbackslash win95}\texttt{\textbackslash winnt}\texttt{\textbackslash mixed}]}
  \end{itemize}

  Defines the behaviour for creation and display of filenames which fit into 8.3
  characters. If a long name for a file exists, it will always be preferred display. There
  are four modes:
  \begin{itemize}
    \item lower
  \end{itemize}

Force the short name to lower case upon display; store a long name when the short name is not all upper case.

**win95**

Force the short name to upper case upon display; store a long name when the short name is not all upper case.

**winnt**

Display the short name as is; store a long name when the short name is not all lower case or all upper case.

**mixed**

Display the short name as is; store a long name when the short name is not all upper case.

The default is "lower".

**Mount options for USBfs**

devuid=uid and devgid=gid and devmode=mode

Set the owner and group and mode of the device files in the USBfs file system (default: uid=gid=0, mode=0644). The mode is given in octal.

busuid=uid and busgid=gid and busmode=mode

Set the owner and group and mode of the bus directories in the USBfs file system (default: uid=gid=0, mode=0555). The mode is given in octal.

listuid=uid and listgid=gid and listmode=mode

Set the owner and group and mode of the file devices (default: uid=gid=0, mode=0444). The mode is given in octal.

**Mount options for xenix**

None.

**Mount options for xfs**

biosize=size

Sets the preferred buffered I/O size (default size is 64K). size must be expressed as the logarithm (base2) of the desired I/O size. Valid values for this option are 14 through 16, inclusive (i.e. 16K, 32K, and 64K bytes). On machines with a 4K pagesize, 13 (8K bytes) is also a valid size. The preferred buffered I/O size can also be altered on an individual file basis using the ioctl(2) system call.

dmapi " / " xdsf

Enable the DMAPi (Data Management API) event callouts.

logbufs=value

Set the number of in-memory log buffers. Valid numbers range from 2-8 inclusive. The default value is 8 buffers for filesystems with a blocksize of 64K, 4 buffers for filesystems with a blocksize of 32K, 3 buffers for filesystems with a blocksize of 16K, and 2 buffers for all other configurations. Increasing the number of buffers may increase performance on some workloads at the cost of the memory used for the additional log buffers and their associated control structures.

logbsize=value

Set the size of each in-memory log buffer. Valid sizes are 16384 (16K) and 32768 (32K). The default value for machines with more than 32MB of memory is 32768, machines with less memory use 16384 by default.
logdev=device and rtdev=device
Use an external log (metadata journal) and/or real-time device. An XFS filesystem has up to three parts: a data section, a log section, and a real-time section. The real-time section is optional, and the log section can be separate from the data section or contained within it. Refer to xfs(5).

noalign
Data allocations will not be aligned at stripe unit boundaries.

noatime
Access timestamps are not updated when a file is read.

norecovery
The filesystem will be mounted without running log recovery. If the filesystem was not cleanly unmounted, it is likely to be inconsistent when mounted in norecovery mode. Some files or directories may not be accessible because of this. Filesystems mounted norecovery must be mounted read-only or the mount will fail.

nouid
Ignore the filesystem uuid. This avoids errors for duplicate uuids.

osync|dsync
Make writes to files opened with the O_SYNC flag set behave as if the O_DSYNC flag had been used instead. This can result in better performance without compromising data safety. However if this option is in effect, timestamp updates from O_SYNC writes can be lost if the system crashes.

quota / usqquota / uqnoenforce
User disk quota accounting enabled, and limits (optionally) enforced.

grpquota / gqnoenforce
Group disk quota accounting enabled and limits (optionally) enforced.

sunit=value and swidth=value
Used to specify the stripe unit and width for a RAID device or a stripe volume. value must be specified in 512-byte block units. If this option is not specified and the filesystem was made on a stripe volume or the stripe width or unit were specified for the RAID device at mkfs time, then the mount system call will restore the value from the superblock. For filesystems that are made directly on RAID devices, these options can be used to override the information in the superblock if the underlying disk layout changes after the filesystem has been created. The swidth option is required if the sunit option has been specified, and must be a multiple of the sunit value.

Mount options for xiafs
None. Although nothing is wrong with xiafs, it is not used much, and is not maintained. Probably one shouldn't use it. Since Linux version 2.1.21 xiafs is no longer part of the kernel source.

the Loop Device
One further possible type is a mount via the loop device. For example, the command

mount /tmp/fdimage /mnt -t msdos -o loop=/dev/loop3,blocksize=1024

will set up the loop device /dev/loop3 to correspond to the file /tmp/fdimage, and then mount this device on /mnt.
This type of mount knows about three options, namely loop, offset and encryption, that are really options to losetup(8). (These options can be used in addition to those specific to the filesystem type.)

If no explicit loop device is mentioned (but just an option ‘-o loop’ is given), then mount will try to find some unused loop device and use that. If you are not so unwise as to make /etc/mtab a symbolic link to /proc-mounts then any loop device allocated by mount will be freed by umount. You can also free a loop device by hand, using ‘losetup -d’, see losetup(8).

Return Codes
mount has the following return codes (the bits can be ORed):

1. success
2. incorrect invocation or permissions
3. system error (out of memory, cannot fork, no more loop devices)
4. internal mount bug or missing nfs support in mount
5. user interrupt
6. problems writing or locking /etc/mtab
7. mount failure
8. some mount succeeded

Files
/etc/fstab
    file system table
/etc/mtab
    table of mounted file systems
/etc/mtab~
    lock file
/etc/mtab.tmp
    temporary file
/etc/filesystems
    a list of filesystem types to try

See Also
mount(2), umount(2), fstab(5), umount(8), swapon(8), nfs(5), xfs(5), e2label(8), xfs_admin(8), mountd(8), nfsd(8), mke2fs(8), tune2fs(8), losetup(8)

Bugs
It is possible for a corrupted file system to cause a crash.

Some Linux file systems don't support -o sync and -o dirsync (the ext2, ext3, fat and vfat file systems do support synchronous updates (a la BSD) when mounted with the sync option).

The -o remount may not be able to change mount parameters (all ext2fs-specific parameters, except sb, are changeable with a remount, for example, but you can't change gid or umask for the fatfs).

Mount by label or uuid will work only if your devices have the names listed in /proc/partitions. In particular, it may well fail if the kernel was compiled with devfs but devfs is not mounted.
It is possible that files /etc/mtab and /proc/mounts don't match. The first file is based only on the mount command options, but the content of the second file also depends on the kernel and others settings (e.g. remote NFS server. In particular case the mount command may reports unreliable information about a NFS mount point and the /proc/mounts file usually contains more reliable information.) Checking files on NFS filesystem referenced by file descriptors (i.e. the fcntl and ioctl families of functions) may lead to inconsistent result due to the lack of consistency check in kernel even if noac is used.

History
A mount command existed in Version 5 AT&T UNIX.
**Affuse**

**Usage:** affuse [<FUSE library options>] af_image mount_point

**FUSE options:**
- `-d` `-o debug` enable debug output (implies `-f`)
- `-f` foreground operation
- `-s` disable multi-threaded operation
- `-o allow_other` allow access to other users
- `-o allow_root` allow access to root
- `-o nonempty` allow mounts over non-empty file/dir
- `-o default_permissions` enable permission checking by kernel
- `-o fsname=NAME` set filesystem name
- `-o subtype=NAME` set filesystem type
- `-o large_read` issue large read requests (2.4 only)
- `-o max_read=N` set maximum size of read requests
- `-o hard_remove` immediate removal (don’t hide files)
- `-o use_ino` let filesystem set inode numbers
- `-o readdir_ino` try to fill in d_ino in readdir
- `-o direct_io` use direct I/O
- `-o kernel_cache` cache files in kernel
- `-o [no]auto_cache` enable caching based on modification times (off)
- `-o umask=M` set file permissions (octal)
- `-o uid=N` set file owner
- `-o gid=N` set file group
- `-o entry_timeout=T` cache timeout for names (1.0s)
- `-o negative_timeout=T` cache timeout for deleted names (0.0s)
- `-o attr_timeout=T` cache timeout for attributes (1.0s)
- `-o ac_attr_timeout=T` auto cache timeout for attributes (attr_timeout)
- `-o intr` allow requests to be interrupted
- `-o intr_signal=NUM` signal to send on interrupt (10)
- `-o modules=M1[,M2...]` names of modules to push onto filesystem stack
- `-o max_write=N` set maximum size of write requests
- `-o max_readahead=N` set maximum readahead
- `-o async_read` perform reads asynchronously (default)
- `-o sync_read` perform reads synchronously
- `-o atomic_o_truncate` enable atomic open+truncate support
- `-o big_writes` enable larger than 4kB writes
- `-o no_remote_lock` disable remote file locking

**Module options:**
- `[subdir]`
  - `-o subdir=DIR` prepend this directory to all paths (mandatory)
  - `-o [no]rellinks` transform absolute symlink to relative
- `[iconv]`
  - `-o from_code=CHARSET` original encoding of file names (default: UTF-8)
  - `-o to_code=CHARSET` new encoding of the file names (default: UTF-8)

Use fusermount -u mount_point, to unmount
Md5sum
csum,md5sum,sum - print file checksum and block count

SYNOPSIS
csum,md5sum,sum [options] [file ...]

DESCRIPTION
sum lists the checksum, and for most methods the block count, for each file argument. The standard input is read if there are no file arguments. getconf UNIVERSE determines the default sum method: att for the att universe, bsd otherwise. The default for the other commands is the command name itself. The att method is a true sum, all others are order dependent. Method names consist of a leading identifier and 0 or more options separated by -.

getconf PATH_RESOLVE determines how symbolic links are handled. This can be explicitly overridden by the --logical, --metaphysical, and --physical options below. PATH_RESOLVE can be one of:
logical
    Follow all symbolic links.
metaphysical
    Follow command argument symbolic links, otherwise don't follow.
physical
    Don't follow symbolic links.

OPTIONS
-a, --all
    List the checksum for all files. Use with --total to list both individual and total checksums and block counts.
-b, --binary
    Read files in binary mode. This is the default.
-B, --scale=scale
    Block count scale (bytes per block) override for methods that include size in the output. The default is method specific.
-c, --check
    Each file is interpreted as the output from a previous sum. If --header or --permissions was specified in the previous sum then the checksum method is automatically determined, otherwise --method must be specified. The listed checksum is compared with the current value and a warning is issued for each file that does not match. If file was generated by --permissions then the file mode, user and group are also checked. Empty lines, lines starting with #<space>, or the line # are ignored. Lines containing no blanks are interpreted as [no]name[=value] options:
method=name
    Checksum method to apply to subsequent lines.
permissions
    Subsequent lines were generated with --permissions.
-h, --header
    Print the checksum method as the first output line. Used with --check and --permissions.
-l, --list
    Each file is interpreted as a list of files, one per line, that is checksummed.
-p, --permissions
If \--check is not specified then list the file mode, user and group between the checksum and path. User and group matching the caller are output as -\. If \--check is specified then the mode, user and group for each path in file are updated if necessary to match those in file . A warning is printed on the standard error for each changed file.  
\-R, \--recursive  
Recursively checksum the contents of directories.  
\-S, \--silentstatus  
No output for \--check; 0 exit status means all sums matched, non-0 means at least one sum failed to match. Ignored for \--permissions.  
\-t, \--total  
List only the total checksum and block count of all files. \--all \--total lists each checksum and the total. The total checksum and block count may be different from the checksum and block count of the catenation of all files due to partial blocks that may occur when the files are treated separately.  
\-T, \--text  
Read files in text mode (i.e., treat \n as \n).  
\-w, \--warn  
Warn about invalid \--check lines. On by default; \-w means \--nowarn.  
\-x, \--methodalgorithm=method  
Specifies the checksum method to apply. Parenthesized method options are readonly implementation details.  
\ssl/s5\default  
The system 5 release 4 checksum. This is the default for sum when getconf UNIVERSE is \ast . This is the only true sum; all of the other methods are order dependent.  
\ast4l32x4tw  
The ast 128 bit PRNG hash generated by catenating 4 separate 32 bit PNPRG hashes. The block count is not printed.  
\bsdlueb  
The BSD checksum.  
\crc  
32 bit CRC (cyclic redundancy check).  
polynomial=mask  
The 32 bit crc polynomial bitmask with implicit bit 32. The default value is 0xedb88320.  
done[=number]  
XOR the final crc value with number. 0xffffffff is used if number is omitted. The option value may be omitted. The default value is 0.  
init[=number]  
The initial crc value. 0xffffffff is used if number is omitted. The option value may be omitted. The default value is 0.  
rotate  
XOR each input character with the high order crc byte (instead of the low order).  
size[=number]  
Include the total number of bytes in the crc. number , if specified, is first XOR'd into the size. The option value may be omitted. The default value is 0.
prng
  32 bit PRNG (pseudo random number generator) hash.
  mpy=number
    The 32 bit PRNG multiplier. The default value is 0x01000193.
  add=number
    The 32 bit PRNG addend. The default value is 0.
  init[=number]
    The PRNG initial value. 0xffffffff is used if number is omitted. The option
    value may be omitted. The default value is 0x811c9d5c.
md5MD5
  The RSA Data Security, Inc. MD5 Message-Digest Method, 1991-2, used with
  permission. The block count is not printed.
  (version)
  md5 (RSA Data Security, Inc. MD5 Message-Digest, 1991-2) 1996-02-29
  sha1SHA1sha-1SHA-1
    FIPS 180-1 SHA-1 secure hash algorithm 1.
  (version)
  sha1 (FIPS 180-1) 1996-09-26
  (author)
  Steve Reid <steve@edmweb.com>
  sha256sha-256SHA256SHA-256
    FIPS SHA-256 secure hash algorithm.
  (version)
  sha-256 (FIPS) 2000-01-01
  (author)
  Aaron D. Gifford
  sha384sha-384SHA384SHA-384
    FIPS SHA-384 secure hash algorithm.
  (version)
  sha-384 (FIPS) 2000-01-01
  (author)
  Aaron D. Gifford
  sha512sha-512SHA512SHA-512
    FIPS SHA-512 secure hash algorithm.
  (version)
  sha-512 (FIPS) 2000-01-01
  (author)
  Aaron D. Gifford
posix\cksum|std\lst\standard
  The posix 1003.2-1992 32 bit crc checksum. This is the default cksum(1)
  method. Shorthand for crc-0x04c11db7-rotate-done-size.
  zip
    The zip(1) crc. Shorthand for crc-0xedb88320-init-done.
  fddi
    The FDDI crc. Shorthand for crc-0xedb88320-size=0xcc55cc55.
  fnv|fnv1
    The Fowler-Noll-Vo 32 bit PRNG hash with non-zero initializer (FNV-1).
    Shorthand for prng-0x01000193-init=0x811c9d5c.
**aststrsum**

The ast strsum(3) PRNG hash. Shorthand for prng-0x63c63cd9-add=0x9e39c33d.

- **-L**, --logical
  Follow symbolic links when traversing directories. The default is determined by getconf PATH_RESOLVE.

- **-H**, --metaphysical
  Follow command argument symbolic links, otherwise don't follow symbolic links when traversing directories. The default is determined by getconf PATH_RESOLVE.

- **-P**, --physical
  Don't follow symbolic links when traversing directories. The default is determined by getconf PATH_RESOLVE.

- **-r**, --bsd
  Equivalent to --method=bsd --scale=512 for compatibility with other sum(1) implementations.

- **-s**, --sysv
  Equivalent to --method=sys5 for compatibility with other sum(1) implementations.

**SEE ALSO**

getconf(1), tw(1), uuencode(1)

**IMPLEMENTATION**

version
  sum (AT&T Research) 2009-11-28

author
  Glenn Fowler <gsf@research.att.com>

author
  David Korn <dgk@research.att.com>

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  http://www.opensource.org/licenses/cpl1.0.txt

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**Sha1sum**

sha1sum - compute and check SHA1 message digest

**Synopsis**

sha1sum [OPTION] [FILE]...

**Description**

Print or check SHA1 (160-bit) checksums. With no FILE, or when FILE is -, read standard input.

- **-b**, --binary
  read in binary mode

- **-c**, --check
  read SHA1 sums from the FILEs and check them

- **-t**, --text
  read in text mode (default)

The following two options are useful only when verifying checksums:

- **--status**
  don't output anything, status code shows success

- **-w**, --warn
warn about improperly formatted checksum lines
--help
   display this help and exit
--version
   output version information and exit

The sums are computed as described in FIPS-180-1. When checking, the input
should be a former output of this program. The default mode is to print a line with
checksum, a character indicating type ('*' for binary, ' ' for text), and name for each
FILE.

Author
Written by Ulrich Drepper, Scott Miller, and David Madore.

Reporting Bugs
Report bugs to <bug-coreutils@gnu.org>.

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General Public License <http://www.gnu.org/licenses/gpl.html>. There is NO
WARRANTY, to the extent permitted by law.

See Also
The full documentation for sha1sum is maintained as a Texinfo manual. If the info
and sha1sum programs are properly installed at your site, the command
info sha1sum
should give you access to the complete manual.

Referenced By
cfv(1), cksfv(1), monit(1), openvpn(8), prelink(8)
- **Md5, sha1, sha256 deep**

md5deep - Compute and compare MD5 message digests
sha1deep - Compute and compare SHA-1 message digests
sha256deep - Compute and compare SHA-256 message digests
tigerdeep - Compute and compare Tiger message digests
whirlpooledep - Compute and compare Whirlpool message digests

**Synopsis**

md5deep -v | -V | -h

**Description**

Computes the hashes, or message digest, for any number of files while optionally recursively digging through the directory structure. Can also take a list of known hashes and display the filenames of input files whose hashes either do or do not match any of the known hashes. Errors are reported to standard error. If no FILES are specified, reads from standard input.

- **p <size>**
  
  Piecewise mode. Breaks files into chunks before hashing. Chunks may be specified using multipliers b, k, m, g, t, p, or e. (Never let it be said that the author didn't plan ahead!) This mode cannot be used with the -z mode.

- **-l-I <size>**
  
  Size threshold mode. Only hash files smaller than the given the threshold. In -i mode, simply omits those files larger than the threshold. In -I mode, displays all files, but uses asterisks for the hashes of files larger than the threshold. Sizes may be specified using multipliers b, k, m, g, t, p, or e.

- **-r**
  
  Enables recursive mode. All subdirectories are traversed. Please note that recursive mode cannot be used to examine all files of a given file extension. For example, calling md5deep -r *.txt will examine all files in directories that end in .txt.

- **-e**
  
  Displays a progress indicator and estimate of time remaining for each file being processed. Time estimates for files larger than 4GB are not available on Windows. This mode may not be used with th -p mode.

- **-m <file>**
  
  Enables matching mode. The file given should be a list of known hashes. The input files are examined one at a time, and only those files that match the list of known hashes are output. This flag may be used more than once to add multiple sets of known hashes. Acceptable formats for lists of known hashes are plain (such as those generated by md5deep or md5sum), Hashkeeper files, iLook, and the National Software Reference Library (NSRL) as produced by the National Institute for Standards in Technology.

  If standard input is used with the -m flag, displays "stdin" if the input matches one of the hashes in the list of known hashes. If the hash does not match, the program displays no output.

  This flag may not be used in conjunction with the -x, -X, or -A flags. See the section "UNICODE SUPPORT" below.
-x <file>
  Same as the -m flag above, but does negative matching. That is, only those files
  NOT in the list of known hashes are displayed.
  This flag may not be used in conjunction with the -m, -M, or -a flags. See the
  section "UNICODE SUPPORT" below.
-M and -X <file>
  Same as -m and -x above, but displays the hash for each file that does (or does not)
  match the list of known hashes.
-a <hash>
  Adds a single hash to the list of known hashes used for matching mode, and if not
  already enabled, enables matching mode. Adding single hashes cannot, by itself, be
  used to print the hashes of matching files like the -M flag does. When used in
  conjunction with the -w flag, the filename displayed is just the hash submitted on the
  command line.
  This flag may not be used in conjunction with the -x, -X, or -A flags.
-A <hash>
  Same as -a above, but does negative matching. This flag may not be used in
  conjunction with the -m, -M, or -A flags.
-f <file>
  Takes a list of files to be hashed from the specified file. Each line is assumed to be
  a filename. This flag can only be used once per invocation. If it's used a second time,
  the second instance will clobber the first.
-w
  During any of the matching modes (-m,-M,-x,or -X), displays the filename of the
  known hash that matched the input file. See the section "UNICODE SUPPORT"
  below.
-t
  Display a timestamp in GMT with each result. On Windows this timestamp will be
  the file's creation time. On all other systems it should be the file's change time.
-n
  During any of the matching modes (-m,-M,-x,or -X), displays only the filenames
  of any known hashes that were not matched by any of the input files.
-s
  Enables silent mode. All error messages are supressed.
-S
  Like silent mode, but still displays warnings on improperly formatted hashes in the
  list of known hashes.
-z
  Enables file size mode. Prepends the hash with a ten digit representation of the
  size of each file processed. If the file size is greater than 9999999999 bytes (about
  9.3GB) the program displays 9999999999 for the size.
-q
  Quiet mode. File names are omitted from the output.
-0
  Uses a NULL character (/0) to terminate each line instead of a newline. Useful for
  processing filenames with strange characters.
-l
Enables relative file paths. Instead of printing the absolute path for each file, displays the relative file path as indicated on the command line. This flag may not be used in conjunction with the -b flag.

-b
Enables bare mode. Strips any leading directory information from displayed filenames. This flag may not be used in conjunction with the -l flag.

-k
Enables asterisk mode. An asterisk is inserted in lieu of a second space between the filename and the hash, just like md5sum in its binary (-b) mode.

-c
Enables comma separated values output, or CSV mode. This mode has the side effect of removing the 10 digit size limitation from -z mode. Also note that asterisks from -k mode are not displayed when in CSV mode.
-o <bcpflsd>
Enables expert mode. Allows the user specify which (and only which) types of files are processed. Directory processing is still controlled with the -r flag. The expert mode options allowed are:
  f - Regular files
  b - Block Devices
  c - Character Devices
  p - Named Pipes
  l - Symbolic Links
  s - Sockets
  d - Solaris Doors

-h
Show a help screen and exit.

-v
Show the version number and exit.

-V
Show copyright information and exit.

Unicode Support
As of version 2.0 the program supports Unicode characters in filenames on Microsoft Windows systems. Due to limitations in Windows, however, each Unicode character is represented as a question mark (?) in the output. Note that Unicode characters are not supported in the files containing known hashes. You can specify a file of known hashes that has Unicode characters in its name by using tab completion or an asterisk (e.g. md5deep -m *.txt where there is only one file with a .txt extension).

Return Value
Returns a bit-wise value based on the success of the operation and the status of any matching operations.
1. Success. Note that the program considers itself successful even when it encounters read errors, permission denied errors, or finds directories when not in recursive mode.
2. Unused hashes. Under any of the matching modes, returns this value if one or more of the known hashes was not matched by any of the input files.
3. Unmatched inputs. Under any of the matching modes, returns this value if one or more of the input values did not match any of the known hashes.
4. User error, such as trying to do both positive and negative matching at the same time.
5. Internal error, such as memory corruption or uncaught cycle. All internal errors should be reported to the developer! See the section "Reporting Bugs" below.

**Author**
md5deep was written by Jesse Kornblum, research [at] jessekornblum [dot] com.

**Known Issues**
Using the -r flag cannot be used to recursively process all files of a given extension in a directory. This is a feature, not a bug. If you need to do this, use the find(1) command.

**Reporting Bugs**
We take all bug reports very seriously. Any bug that jeopardizes the forensic integrity of this program could have serious consequences on people's lives. When submitting a bug report, please include a description of the problem, how you found it, and your contact information.
Send bug reports to the author at the address above.

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**See Also**
More information and installation instructions can be found in the README file. Current versions of both documents can be found on the project homepage:
http://md5deep.sourceforge.net/
The MD5 specification, RFC 1321, is available at
http://www.ietf.org/rfc/rfc1321.txt
The SHA-1 specification, RFC 3174, is available at
http://www.faqs.org/rfcs/rfc3174.html
The SHA-256 specification, FIPS 180-2, is available at
The Tiger specification is available at
http://www.cs.technion.ac.il/~biham/Reports/Tiger/
The Whirlpool specification is available at
- **Dhash**

**DHash 2.0.1 - Terminal Version **

**Usage:**
dhash -t -f FILE HASH_ALGO1 [HASH_ALGO2] [HASH_ALGO3] [OPTIONS]

- **t** Terminal interface
- **f** file to hashing
- **o** output acquire file
- **c** compress Output file (bz2)

**HASH_ALGO:**
--md5 calculate md5
--sha1 calculate sha1
--svf calculate svf

**OPTIONS:**
--md5file file for check md5 hash
--sha1file file for check sha1 hash
-l | --log logging into html file
--language=[LANGUAGE] [LANGUAGE]: IT,EN,....

**Example:**
dhash -t -f linux.iso --md5 --sha1 --md5file linuxsum.md5 -l dhash.log.html --language=EN

- **GREP**

**NAME**
grep, egrep, fgrep, rgrep - print lines matching a pattern

**SYNOPSIS**
grep [options] PATTERN [FILE...]

grep [options] [-e PATTERN | -f FILE] [FILE...]

**DESCRIPTION**
grep searches the named input FILES (or standard input if no files are
named, or the file name - is given) for lines containing a
match to the
given PATTERN. By default, grep prints the matching lines.

In addition, three variant programs egrep, fgrep and rgrep
are avai-
able. egrep is the same as grep -E. fgrep is the same as
grep -F.
rgrep is the same as grep -r.

**OPTIONS**
-A NUM, --after-context=NUM
   Print NUM lines of trailing context after
   matching lines.
   Places a line containing -- between
   contiguous groups of
   matches.

-a, --text
   Process a binary file as if it were text; this is
   equivalent to
   the --binary-files=text option.

-B NUM, --before-context=NUM
   Print NUM lines of leading context before
   matching
   lines.
   Places a line containing -- between
   contiguous groups of
   matches.

-b, --byte-offset
   Print the byte offset within the input file before
   each line of
   output.

--binary-files=TYPE
   If the first few bytes of a file indicate that the
   file contains
   binary data, assume that the file is of type TYPE. By
   default, TYPE is binary, and grep normally outputs either a
   one-line mes-
   sage saying that a binary file matches, or no message
   if there
   is no match. If TYPE is without-match, grep
   assumes that a
   binary file does not match; this is equivalent to the
   -I option. If TYPE is text, grep processes a binary file as
   if it were
   text; this is equivalent to the -a option.
   Warning: grep
   --binary-files=text might output binary garbage,
   which can have
   nasty side effects if the output is a terminal and if
   the termi-
   nal driver interprets some of it as commands.

-C NUM, --context=NUM
   Print NUM lines of output context. Places a line
   containing --
   between contiguous groups of matches.

-c, --count
   Suppress normal output; instead print a count of
   matching lines
   for each input file. With the -v, --invert-match
   option (see
below), count non-matching lines.

--colour=WHEN, --color=WHEN
Surround the matching string with the marker find in
GREP_COLOR
environment variable. WHEN may be 'never', 'always',
or 'auto'

-D ACTION, --devices=ACTION
If an input file is a device, FIFO or socket, use
ACTION to pro-
cess it. By default, ACTION is read, which means that
devices
are read just as if they were ordinary files. If
ACTION is
skip, devices are silently skipped.

-d ACTION, --directories=ACTION
If an input file is a directory, use ACTION to process
it. By
default, ACTION is read, which means that directories
are read just as if they were ordinary files. If ACTION is
skip, direc-
tories are silently skipped. If ACTION is recurse,
grep reads
all files under each directory, recursively; this is
equivalent
to the -r option.

-E, --extended-regexp
Interpret PATTERN as an extended regular expression
(see below).

-e PATTERN, --regexp=PATTERN
Use PATTERN as the pattern; useful to protect patterns
beginning
with -.

-F, --fixed-strings
Interpret PATTERN as a list of fixed strings,
separated by new-
lines, any of which is to be matched.

-f FILE, --file=FILE
Obtain patterns from FILE, one per line. The
empty file con-
tains zero patterns, and therefore matches nothing.

-G, --basic-regexp
Interpret PATTERN as a basic regular expression
(see below).
This is the default.

-H, --with-filename
Print the filename for each match.

-h, --no-filename
Suppress the prefixing of filenames on output when multiple files are searched.

--help Output a brief help message.

-I Process a binary file as if it did not contain matching data; this is equivalent to the --binary-files-without-match option.

-i, --ignore-case Ignore case distinctions in both the PATTERN and the input files.

-L, --files-without-match Suppress normal output; instead print the name of each input file from which no output would normally have been printed. The scanning will stop on the first match.

-l, --files-with-matches Suppress normal output; instead print the name of each input file from which output would normally have been printed. The scanning will stop on the first match.

--label=LABEL Displays input actually coming from standard input as input coming from file LABEL. This is especially useful for tools like zgrep, e.g. gzip -cd foo.gz | grep --label=foo something

--line-buffered Use line buffering, it can be a performance penalty.

-m NUM, --max-count=NUM Stop reading a file after NUM matching lines. If the input is standard input from a regular file, and NUM matching lines are positioned just after the last matching line before exiting, regardless of the presence of trailing context lines. This enables a calling process to resume a search. When grep stops after NUM matching lines, it outputs any trailing context lines. When the -c or --count option is also used, grep does not output a count greater than NUM. When the -v or --invert-match option is also
used, grep stops after outputting NUM non-matching lines.

--mmap If possible, use the mmap(2) system call to read input, instead of the default read(2) system call. In some situations, --mmap yields better performance. However, --mmap can cause undefined behavior (including core dumps) if an input file shrinks while grep is operating, or if an I/O error occurs.

-n, --line-number
Prefix each line of output with the line number within its input file.

-o, --only-matching
Show only the part of a matching line that matches PATTERN.

-P, --perl-regexp
Interpret PATTERN as a Perl regular expression.

-q, --quiet, --silent
Quiet; do not write anything to standard output. Exit immediately with zero status if any match is found, even if an error was detected. Also see the -s or --no-messages option.

-R, -r, --recursive
Read all files under each directory, recursively; this is equivalent to the -d recurse option.

--include=PATTERN
Recurse in directories only searching file matching PATTERN.

--exclude=PATTERN
Recurse in directories skip file matching PATTERN.

-s, --no-messages
Suppress error messages about nonexistent or unreadable files.

Portability note: unlike GNU grep, traditional grep did not conform to POSIX.2, because traditional grep lacked a -q option and its -s option behaved like GNU grep's -q option. Shell scripts intended to be portable to traditional grep should avoid both -q and -s and should redirect output to /dev/null instead.
-U, --binary
    Treat the file(s) as binary. By default, under MS-DOS and MS-Windows, grep guesses the file type by looking at the contents of the first 32KB read from the file. If grep decides the file is a text file, it strips the CR characters from the original file contents (to make regular expressions with ^ correctly). Specifying -U overrules this guesswork, causing all files to be read and passed to the matching mechanism of each file. This will cause some regular expressions to fail. This option has no effect on platforms other than MS-DOS and MS-Windows.

-u, --unix-byte-offsets
    Report Unix-style byte offsets. This switch causes grep to report byte offsets as if the file were Unix-style text file, i.e. with CR characters stripped off. This will produce results identical to running grep on a Unix machine. This option has no effect unless -b option is also used; it has no effect on platforms other than MS-DOS and MS-Windows.

-V, --version
    Print the version number of grep to standard error. This version number should be included in all bug reports (see below).

-v, --invert-match
    Invert the sense of matching, to select non-matching lines.

-w, --word-regexp
    Select only those lines containing matches that form whole words. The test is that the matching substring must either be at the beginning of the line, or preceded by a non-word constituent character. Similarly, it must be either at the end of the line or followed by a non-word constituent character. Word-
constituent characters are letters, digits, and the underscore.

-\x, --line-regexp
  Select only those matches that exactly match the whole line.

-\y
  Obsolete synonym for -i.

-\Z, --null
  Output a zero byte (the ASCII NUL character) instead of the character that normally follows a file name. For example, grep -lZ outputs a zero byte after each file name instead of the usual newline. This option makes the output unambiguous, even in the presence of file names containing unusual characters like newlines. This option can be used with commands like find -print0, perl -o, sort -z, and xargs -0 to process arbitrary file names, even those that contain newline characters.

-\z, --null-data
  Treat the input as a set of lines, each terminated by a zero byte (the ASCII NUL character) instead of a newline. Like the -\Z or --null option, this option can be used with commands like sort -z to process arbitrary file names.

REGULAR EXPRESSIONS

A regular expression is a pattern that describes a set of strings. Regular expressions are constructed analogously to arithmetic expressions, by using various operators to combine smaller expressions.

grep understands three different versions of regular expression syntax:
  "basic", "extended," and "perl." In GNU grep, there is no difference in available functionality using either of the first two syntaxes. In other implementations, basic regular expressions are less powerful.

The following description applies to extended regular expressions; differences for basic regular expressions are summarized afterwards. Perl regular expressions add additional functionality, but the implementa-
tion used here is undocumented and is not compatible with other grep implementations.

The fundamental building blocks are the regular expressions that match a single character. Most characters, including all letters and digits, are regular expressions that match themselves. Any metacharacter with special meaning may be quoted by preceding it with a backslash.

A bracket expression is a list of characters enclosed by [ and ]. It matches any single character in that list; if the first character of the list is the caret ^ then it matches any character not in the list. For example, the regular expression \[0123456789\] matches any single digit.

Within a bracket expression, a range expression consists of two characters separated by a hyphen. It matches any single character that sorts between the two characters, inclusive, using the locale’s collating sequence and character set. For example, in the default C locale, [a-d] is equivalent to [abcd]. Many locales sort characters in dictionary order, and in these locales [a-d] is typically not equivalent to [abcd]; it might be equivalent to [aBbCcDd], for example. To obtain the traditional interpretation of bracket expressions, you can use the C locale by setting the LC_ALL environment variable to the value C.

Finally, certain named classes of characters are predefined within bracket expressions, as follows. Their names are self explanatory, and they are [:alnum:], [:alpha:], [:cntrl:], [:digit:], [:graph:], [:lower:], [:print:], [:punct:], [:space:], [:upper:], and [:xdigit:].

For example, [:alnum:] means [0-9A-Za-z], except the latter form depends upon the C locale and the ASCII character encoding, whereas the former is independent of locale and character set. (Note that the brackets in these class names are part of the symbolic names, and must
be included in addition to the brackets delimiting the bracket list.)
Most metacharacters lose their special meaning inside lists. To
include a literal ] place it first in the list.
Similarly, to include a literal ^ place it anywhere but first. Finally, to include a literal
- place it last.

The period . matches any single character. The symbol \w is a synonym
for [:alnum:] and \W is a synonym for [^[[:alnum]]].

The caret ^ and the dollar sign $ are metacharacters that respectively
match the empty string at the beginning and end of a line.
The symbols \< and \> respectively match the empty string at the beginning and end of a word. The symbol \b matches the empty string at the edge of a word, and \B matches the empty string provided it's not at the edge of a word.

A regular expression may be followed by one of several repetition operators:
? The preceding item is optional and matched at most once.
* The preceding item will be matched zero or more times.
+ The preceding item will be matched one or more times.
{n} The preceding item is matched exactly n times.
{n,} The preceding item is matched n or more times.
{n,m} The preceding item is matched at least n times, but not more than m times.

Two regular expressions may be concatenated; the resulting regular expression matches any string formed by concatenating two substrings that respectively match the concatenated subexpressions.

Two regular expressions may be joined by the infix operator |; the resulting regular expression matches any string matching either subexpression.

Repetition takes precedence over concatenation, which in turn takes precedence over alternation. A whole subexpression may be enclosed in parentheses to override these precedence rules.
The backreference \n, where n is a single digit, matches the substring
previously matched by the nth parenthesized subexpression of
the regular expression.

In basic regular expressions the metacharacters ?, +, {, |, 
(, )
lose their special meaning; instead use the backslashed
versions \?, 
\+, \{|, \|, \{, and \}.

Traditional egrep did not support the ( metacharacter, and
some egrep
implementations support \( instead, so portable scripts
should avoid \( in egrep patterns and should use \[\] to match a literal \[\].

GNU egrep attempts to support traditional usage by assuming
that \[ is not special if it would be the start of an invalid interval
specification. For example, the shell command egrep '\{1' searches for
the two-character string \{1 instead of reporting a syntax error in
the regular expression. POSIX.2 allows this behavior as an extension,
but portable scripts should avoid it.

ENVIRONMENT VARIABLES

grep's behavior is affected by the following environment
variables:

A locale LC_foo is specified by examining the three
environment vari-
ablees LC_ALL, LC_foo, LANG, in that order. The first of
these vari-
ablees that is set specifies the locale. For example, if
LC_ALL is not
set, but LC_MESSAGES is set to pt_BR, then Brazilian
Portuguese is used
for the LC_MESSAGES locale. The C locale is used if none
of these
environment variables are set, or if the locale
catalog is not
installed, or if grep was not compiled with national
language support
(NLS).

GREP_OPTIONS
This variable specifies default options to be placed
in front of
any explicit options. For example, if
GREP_OPTIONS is
'--binary-files=without-match --directories=skip',
grep behaves
as if the two options --binary-files=without-match and --directories=skip had been specified before any explicit options. Option specifications are separated by whitespace. A backslash escapes the next character, so it can be used to specify an option containing whitespace or a backslash.

GREP_COLOR
Specifies the marker for highlighting.

LC_ALL, LC_COLLATE, LANG
These variables specify the LC_COLLATE locale, which determines the collating sequence used to interpret range expressions like [a-z].

LC_ALL, LC_CTYPE, LANG
These variables specify the LC_CTYPE locale, which determines the type of characters, e.g., which characters are whitespace.

LC_ALL, LC_MESSAGES, LANG
These variables specify the LC_MESSAGES locale, which determines the language that grep uses for messages. The default C locale uses American English messages.

POSIXLY_CORRECT
If set, grep behaves as POSIX.2 requires; otherwise, grep behaves more like other GNU programs. POSIX.2 requires that options that follow file names must be treated as file names; by default, such options are permuted to the front of the operand list and are treated as options. Also, POSIX.2 requires that unrecognized options be diagnosed as "illegal", but since they are not really against the law the default is to diagnose them as "invalid". POSIXLY_CORRECT also disables _N_GNU_nonoption_argv_flags_, described below.

_N_GNU_nonoption_argv_flags_
(Here N is grep's numeric process ID.) If the ith character of this environment variable's value is 1, do not consider the ith operand of grep to be an option, even if it appears to be one.
A shell can put this variable in the environment for each command it runs, specifying which operands are the results of name wildcard expansion and therefore should not be treated as options. This behavior is available only with the GNU C library, and only when POSIXLY_CORRECT is not set.

DIAGNOSTICS

Normally, exit status is 0 if selected lines are found and 1 otherwise.
But the exit status is 2 if an error occurred, unless the -q or --quiet or --silent option is used and a selected line is found.

BUGS

Email bug reports to bug-gnu-utils@gnu.org. Be sure to include the word "grep" somewhere in the "Subject:" field.

Large repetition counts in the \( (n,m) \) construct may cause grep to use lots of memory. In addition, certain other obscure regular expressions require exponential time and space, and may cause grep to run out of memory.

Backreferences are very slow, and may require exponential time.
**DD**

`dd` - convert and copy a file

**Synopsis**

`dd [OPERAND]...`

`dd OPTION`

**Description**

Copy a file, converting and formatting according to the operands.

- `bs=BYTES`  
  force `ibs=BYTES` and `obs=BYTES`
- `cbs=BYTES`  
  convert `BYTES` bytes at a time
- `conv=CONVS`  
  convert the file as per the comma separated symbol list
- `count=BLOCKS`  
  copy only `BLOCKS` input blocks
- `ibs=BYTES`  
  read `BYTES` bytes at a time
- `if=FILE`  
  read from `FILE` instead of stdin
- `iflag=FLAGS`  
  read as per the comma separated symbol list
- `obs=BYTES`  
  write `BYTES` bytes at a time
- `of=FILE`  
  write to `FILE` instead of stdout
- `oflag=FLAGS`  
  write as per the comma separated symbol list
- `seek=BLOCKS`  
  skip `BLOCKS` obs-sized blocks at start of output
- `skip=BLOCKS`  
  skip `BLOCKS` ibs-sized blocks at start of input
- `status=noxfer`  
  suppress transfer statistics

`BLOCKS` and `BYTES` may be followed by the following multiplicative suffixes: `xM`  
`M`, `c 1`, `w 2`, `b 512`, `kB 1000`, `K 1024`, `MB 1000*1000`, `M 1024*1024`, `GB 1000*1000*1000`, `G 1024*1024*1024`, and so on for `T`, `P`, `E`, `Z`, `Y`.

**Each CONV symbol may be:**

- `ascii`  
  from EBCDIC to ASCII
- `ebcdic`  
  from ASCII to EBCDIC
- `ibm`  
  from ASCII to alternate EBCDIC
block
  pad newline-terminated records with spaces to cbs-size
unblock
  replace trailing spaces in cbs-size records with newline
case
  change upper case to lower case
nocreat
  do not create the output file
excl
  fail if the output file already exists
notrunc
  do not truncate the output file
ucase
  change lower case to upper case
swab
  swap every pair of input bytes
noerror
  continue after read errors
sync
  pad every input block with NULs to ibs-size; when used
  with block or unblock, pad with spaces rather than NULs
fdatasync physically write output file data before finishing
  fsync likewise, but also write metadata

Each FLAG symbol may be:
append
  append mode (makes sense only for output)
direct
  use direct I/O for data
dsync
  use synchronized I/O for data
sync
  likewise, but also for metadata
nonblock
  use non-blocking I/O
nofollow
  do not follow symlinks
noctty
  do not assign controlling terminal from file

Sending a USR1 signal to a running 'dd' process makes it print I/O statistics to
standard error and then resume copying.
CWS dd if=/dev/zero of=/dev/null& pid=$!
  CWS kill -USR1 $pid; sleep 1; kill $pid
18335302+0 records in
  18335302+0 records out 9387674624 bytes (9.4 GB) copied, 34.6279 seconds,
  271 MB/s
Options are:
--help
   display this help and exit
--version
   output version information and exit

Author
Written by Paul Rubin, David MacKenzie, and Stuart Kemp.

Reporting Bugs
Report bugs to <bug-coreutils@gnu.org>.

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Copyright 2006 Free Software Foundation, Inc.
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General Public License <http://www.gnu.org/licenses/gpl.html>. There is NO
WARRANTY, to the extent permitted by law.

See Also
The full documentation for dd is maintained as a Texinfo manual. If the info and dd
programs are properly installed at your site, the command
info dd
should give you access to the complete manual.

Referenced By
buffer(1), cdrecord(1), cstream(1), cycbuff.conf(5), gpart(8), myrescue(1), sg_dd(8),
sg_read(8), sgm_dd(8), sgp_dd(8), spax(1), star(1), varnishd(1), wodim(1), xfs(5),
xfscopy(8), xfs_repair(8)
DD rescue

Data recovery tool, save data from a crashed partition.

Syntax

ddrescue [options] infile outfile [logfile]

Options:

- \(-b=bytes\) Hardware block size of input device [512]
--block-size=bytes
- \(-B\) Show binary multipliers in numbers [default SI]
--binary-prefixes
- \(-c=blocks\) Hardware blocks to copy at a time [128]
--cluster-size=blocks
- \(-C\) Do not read new data beyond logfile limits
--complete-only
- \(-d\) Use direct disc access for input file
--direct
- \(-e=n\) Maximum number of error areas allowed
--max-errors=n
- \(-i=pos\) Starting position in input file [0]
--input-position=pos
- \(-n\) Do not try to split error areas
--no-split
- \(-o=pos\) Starting position in output file [ipos]
--output-position=pos
- \(-q\) Quiet operation
--quiet
- \(-r=n\) Exit after given retries (-1=infinity) [0]
--max-retries=n
- \(-s=bytes\) Maximum size of data to be copied
--max-size=bytes
- \(-t\) Truncate output file
--truncate
- \(-v\) Verbose operation
--verbose
- \(-V\) Output version information and exit
--version

Numbers may be followed by a multiplier: b = blocks, k = kB = 10^3 = 1000, Ki = KiB = 2^10 = 1024, M = 10^6, Mi = 2^20, G = 10^9, Gi = 2^30, etc...

Installation

Debian / Ubuntu Linux:
# apt-get install ddrescue

RedHat / Fedora / CentOS Linux:
# yum -y install ddrescue
ddrescue written by Antonio Diaz Diaz, download from the GNU web site.
Installs as /usr/bin/ddrescue

Example:
To copy /dev/sda (damaged /device/harddisk0) to another drive /dev/sdb (empty /device/harddisk1)
# ddrescue /dev/sda /dev/sdb

To recover the partition data run fsck, for example if /home (user data) is on /dev/sda2, run fsck on partition /dev/sdb2:
# fsck /dev/sdb2

This avoids touching the damaged /dev/sda, if the procedure fails you can send the original disk to a professional data recovery service.
Lastly mount the partition somewhere and see if you can access the data:
# mount /dev/sdb2 /mnt/data

"Rescue me, Oh take me in your arms, Rescue me" - Aretha Franklin
**DcflDD**

dcfldd - manual page for dcfldd (dcfldd) 1.3.4

**SYNOPSIS**
dcfldd [OPTION]...

**DESCRIPTION**
Copy a file, converting and formatting according to the options.
bs=BYTES
   force ibs=BYTES and obs=BYTES
cbs=BYTES
   convert BYTES bytes at a time
cnv=KEYWORDS
   convert the file as per the comma separated keyword list
count=BLOCKS
   copy only BLOCKS input blocks
ibs=BYTES
   read BYTES bytes at a time
if=FILE
   read from FILE instead of stdin
obs=BYTES
   write BYTES bytes at a time
of=FILE
   write to FILE instead of stdout
NOTE: of=FILE may be used several times to write
output to multiple files simultaneously
of:=COMMAND
   exec and write output to process COMMAND
seek=BLOCKS
   skip BLOCKS obs-sized blocks at start of output
skip=BLOCKS
   skip BLOCKS ibs-sized blocks at start of input
pattern=HEX
   use the specified binary pattern as input
textpattern=TEXT
   use repeating TEXT as input
errlog=FILE
   send error messages to FILE as well as stderr
hashwindow=BYTES
   perform a hash on every BYTES amount of data
hash=NAME
   either md5, sha1, sha256, sha384 or sha512
default algorithm is md5. To select multiple algorithms to run simultaneously enter
the names in a comma separated list
hashlog=FILE
   send MD5 hash output to FILE instead of stderr
if you are using multiple hash algorithms you can send each to a separate file using the convention ALGORITHMlog=FILE, for example md5log=FILE1, sha1log=FILE2, etc.
hashlog:=COMMAND
  exec and write hashlog to process COMMAND
ALGORITHMlog:=COMMAND also works in the same fashion
hashconv=[before|after]
  perform the hashing before or after the conversions
hashformat=FORMAT
  display each hashwindow according to FORMAT
the hash format mini-language is described below
totalhashformat=FORMAT
  display the total hash value according to FORMAT
status=[on|off]
  display a continual status message on stderr
default state is "on"
statusinterval=N
  update the status message every N blocks
default value is 256
sizeprobe=[ifif]
  determine the size of the input or output file
for use with status messages. (this option gives you a percentage indicator)
WARNING: do not use this option against a tape device.
split=BYTES
  write every BYTES amount of data to a new file
This operation applies to any of=FILE that follows
splitformat=TEXT
  the file extension format for split operation.
you may use any number of 'a' or 'n' in any combo the default format is "nnn"
NOTE: The split and splitformat options take effect
only for output files specified AFTER these options appear in the command line.
Likewise, you may specify these several times for for different output files within the
same command line. you may use as many digits in any combination you would like.
(e.g. "anaamnaana" would be valid, but quite insane)
vf=FILE
  verify that FILE matches the specified input
verifylog=FILE
  send verify results to FILE instead of stderr
verifylog:=COMMAND
  exec and write verify results to process COMMAND
--help
  display this help and exit
--version
  output version information and exit

The structure of of FORMAT may contain any valid text and special variables.
The built-in variables are used the following format: #variable_name# To pass
FORMAT strings to the program from a command line, it may be necessary to
surround your FORMAT strings with "quotes." The built-in variables are listed below:

window_start
  The beginning byte offset of the hashwindow
window_end
  The ending byte offset of the hashwindow
block_start
  The beginning block (by input blocksize) of the window
block_end
  The ending block (by input blocksize) of the hash window
hash
  The hash value
algorithm
  The name of the hash algorithm

For example, the default FORMAT for hashformat and totalhashformat are:

hashformat="#window_start# - #window_end#: #hash#"
totalhashformat="Total (#algorithm#): #hash#"

The FORMAT structure accepts the following escape codes:

\n  Newline
\t  Tab
\r  Carriage return
\\  Insert the \ character
##  Insert the '#' character as text, not a variable

BLOCKS and BYTES may be followed by the following multiplicative suffixes:
xM M, c 1, w 2, b 512, kD 1000, k 1024, MD 1,000,000, M 1,048,576, GD 1,000,000,000, G 1,073,741,824, and so on for T, P, E, Z, Y.

Each KEYWORD may be:

ascii
  from EBCDIC to ASCII
ebcdic
  from ASCII to EBCDIC
ibm
  from ASCII to alternated EBCDIC
block
  pad newline-terminated records with spaces to cbs-size
unblock
  replace trailing spaces in cbs-size records with newline
lcase
  change upper case to lower case
notrunc
  do not truncate the output file
ucase
change lower case to upper case
swab
  swap every pair of input bytes
noerror
  continue after read errors
sync
  pad every input block with NULs to ibs-size; when used with block or unblock,
  pad with spaces rather than NULs

AUTHOR
Written by: dcfldd by Nicholas Harbour, GNU dd by Paul Rubin, David MacKenzie
  and Stuart Kemp.

REPORTING BUGS
Report bugs to <nicholasharbour@yahoo.com>.

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This is free software; see the source for copying conditions. There is NO warranty;
not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR
PURPOSE.
SEE ALSO
The full documentation for dcfldd is maintained as a Texinfo manual. If the info and
dcfldd programs are properly installed at your site, the command

info dcfldd
should give you access to the complete manual.
Fls

fls - List file and directory names in a disk image.

**Synopsis**

fls [-adDFlnuvV] [-m mnt] [-f fstype] [-s seconds] [-i imgtype] [-o imgoffset] [-b dev_sector_size] image [images] [inode]

**Description**

fls lists the files and directory names in the image and can display file names of recently deleted files for the directory using the given inode. If the inode argument is not given, the inode value for the root directory is used. For example, on an NTFS file system it would be 5 and on a Ext3 file system it would be 2.

**The arguments are as follows:**

-a
- Display the "." and "." directory entries (by default it does not)
-d
- Display deleted entries only
-D
- Display directory entries only
-f fstype
- The type of file system. Use `-f list’ to list the supported file system types. If not given, autodetection methods are used.
-F
- Display file (all non-directory) entries only.
-l
- Display file details in long format. The following contents are displayed:
  file_type inode file_name mod_time acc_time chg_time cre_time size uid gid
  -m mnt
- Display files in time machine format so that a timeline can be gid created with
  mactime(1).
  The string given as mnt will be prepended to the file names as the mounting point
  (for example /usr).
-p
- Display the full path for each entry. By default it denotes the directory depth on
  recursive runs with a ‘+’ sign.
-r
- Recursively display directories. This will not follow deleted directories, because it
  can’t.
-s seconds
- The time skew of the original system in seconds. For example, if the original
  system was 100 seconds slow, this value would be -100. This is only used if -l or -m
  are given.
-i imgtype
- Identify the type of image file, such as raw or split. Use `-i list’ to list the
  supported types. If not given, autodetection methods are used.
-o imgoffset
- The sector offset where the file system starts in the image.
-b dev_sector_size
The size, in bytes, of the underlying device sectors. If not given, the value in the image format is used (if it exists) or 512-bytes is assumed.
-u
Display undeleted entries only
-v
Verbose output to stderr.
-V
Display version.
-z zone
The ASCII string of the time zone of the original system. For example, EST or GMT. These strings must be defined by your operating system and may vary.

image [images]
One (or more if split) disk or partition images whose format is given with ‘-i’.
Once the inode has been determined, the file can be recovered using icat(1) from The Coroners Toolkit. The amount of information recovered from deleted file entries varies depending on the system. For example, on Linux, a recently deleted file can be easily recovered, while in Solaris not even the inode can be determined. If you just want to find what file name belongs to an inode, it is easier to use ffind(1).

Examples
To get a list of all files and directories in an image use:
    # fls -r image 2
    or just (if no inode is specified, the root directory inode is used):
    # fls -r image
To get the full path of deleted files in a given directory:
    # fls -d -p image 29
To get the mactime output do:
    # fls -m /usr/local image 2
If you have a disk image and the file system starts in sector 63, use:
    # fls -o 63 disk-img.dd
If you have a disk image that is split use:
    # fls -i "split" -o 63 disk-1.dd disk-2.dd disk-3.dd

See Also
ffind(1) , icat(1)

Author
Brian Carrier <carrier at sleuthkit dot org>
Send documentation updates to <doc-updates at sleuthkit dot org>
Mactime

mactime - Create an ASCII time line of file activity

Synopsis

mactime [-b body ] [-g group file ] [-p password file ] [-i (day|hour) index file ] [-dhmVy] [-z TIME_ZONE ] [DATE_RANGE]

Description

mactime creates an ASCII time line of file activity based on the body file specified by `-b` or from STDIN. The time line is written to STDOUT. The body file must be in the time machine format that is created by `ils -m`, `fls -m`, or the mac-robber tool.

Arguments

-b body
  Specify the location of a body file. This file must be generated by a tool such as `fls -m` or `ils -m`. The 'mac-robber' and 'grave-robber' tools can also be used to generate the file.

-g group file
  Specify the location of the group file. mactime will display the group name instead of the GID if this is given.

-p password file
  Specify the location of the passwd file. mactime will display the user name instead of the UID of this is given.

-i day|hour index file
  Specify the location of an index file to write to. The first argument specifies the granularity, either an hourly summary or daily. If the `-d` flag is given, then the summary will be separated by a `,` to import into a spread sheet.

-d
  Display timeline and index files in comma delimited format. This is used to import the data into a spread sheet for presentations or graphs.

-h
  Display header info about the session including time range, input source, and passwd or group files.

-V
  Display version to STDOUT.

-m
  The month is given as a number instead of name.

-y
  The date range is given with the year first.

-z TIME_ZONE
  The timezone from where the data was collected. The name of this argument is system dependent (examples include EST5EDT, GMT+1).

DATE_RANGE
  The range of dates to make the time line for. The standard format is yyyy-mm-dd for a starting date and no ending date. For an ending date, use yyyy-mm-dd..yyyy-mm-dd.

License
The changes from mactime in TCT and mac-daddy are distributed under the Common Public License, found in the cpl1.0.txt file in the The Sleuth Kit licenses directory.

**History**
A version of mactime first appeared in The Coroner’s Toolkit (TCT) (Dan Farmer) and later mac-daddy (Rob Lee).

**Author**
Brian Carrier <carrier at sleuthkit dot org>
Send documentation updates to <doc-updates at sleuthkit dot org>
Locate

NAME
locate - list files in databases that match a pattern

SYNOPSIS

DESCRIPTION
This manual page documents the GNU version of locate. For each given pattern, locate searches one or more databases of file names and displays the file names that contain the pattern. Patterns can contain shell-style metacharacters: `*`, `?`, and `[]`. The metacharacters do not treat `/` or `.` specially. Therefore, a pattern `foo*bar` can match a file name that contains `foo3/bar`, and a pattern `*duck*` can match a file name that contains `lake/ducky`. Patterns that contain metacharacters should be quoted to protect them from expansion by the shell.

If a pattern is a plain string -- it contains no metacharacters -- locate displays all file names in the database that contain that string anywhere. If a pattern does contain metacharacters, locate only displays file names that match the pattern exactly. As a result, patterns that contain metacharacters should usually begin with a `*`, and will most often end with one as well. The exceptions are patterns that are intended to explicitly match the beginning or end of a file name.

The file name databases contain lists of files that were on the system when the databases were last updated. The system administrator can choose the file name of the default database, the frequency with which the databases are updated, and the directories for which they contain entries; see updatedb(1).

If locate's output is going to a terminal, unusual characters in the output are escaped in the same way as for the `print` action of the find command. If the output is not going to a terminal, file names are printed exactly as-is.

OPTIONS
-A, --all
Print only names which match all non-option arguments, not those matching one or more non-option arguments.
-c, --count
Instead of printing the matched filenames, just print the total number of matches we found, unless --print (-p) is also present.
-d path, --database=path
Instead of searching the default file name database, search the
file name databases in path, which is a colon-separated list of database file names. You can also use the environment variable LOCATE_PATH to set the list of database files to search. The option overrides the environment variable if both are used. Empty elements in the path are taken to be synonyms for the file name of the default database. A database can be supplied on stdin, using `-' as an element of path. If more than one element of path is `-', later instances are ignored (and a warning message is printed).

The file name database format changed starting with GNU find and locate version 4.0 to allow machines with different byte orderings to share the databases. This version of locate can automatically recognize and read databases produced for older versions of GNU locate or Unix versions of locate or find. Support for the old locate database format will be discontinued in a future release.

-e, --existing
Only print out such names that currently exist (instead of such names that existed when the database was created). Note that this may slow down the program a lot, if there are many matches in the database. If you are using this option within a program, please note that it is possible for the file to be deleted after locate has checked that it exists, but before you use it.

-E, --non-existing
Only print out such names that currently do not exist (instead of such names that existed when the database was created). Note that this may slow down the program a lot, if there are many matches in the database.

-L, --follow
If testing for the existence of files (with the -e or -E options), consider broken symbolic links to be non-existing. This is the default.

-P, -H, --nofollow
If testing for the existence of files (with the -e or -E options), treat broken symbolic links as if they were existing files. The -H form of this option is provided purely for similarity with find; the use of -P is recommended over -H.

-i, --ignore-case
Ignore case distinctions in both the pattern and the file names.

-l N, --limit=N
Limit the number of matches to N. If a limit is set via this option, the number of results printed for the -e option will never be larger than this number.

-m, --mmap
Accepted but does nothing, for compatibility with BSD locate.

-O, --null
Use ASCII NUL as a separator, instead of newline.
-p, --print
   Print search results when they normally would not, because of
   the presence of --statistics (-S) or --count (-c).
-w, --wholename
   Match against the whole name of the file as listed in the
   database. This is the default.
-b, --basename
   Results are considered to match if the pattern specified matches
   the final component of the name of a file as listed in the
   database. This final component is usually referred to as the
   'base name'.
-r, --regex
   The pattern specified on the command line is understood to be a
   regular expression, as opposed to a glob pattern. The Regular
   expressions work in the same was as in emacs and find, except
   for the fact that "." will match a newline. Filenames whose
   full paths match the specified regular expression are printed
   (or, in the case of the -c option, counted). If you wish to
   anchor your regular expression at the ends of the full path
   name, then as is usual with regular expressions, you should use
   the characters ^ and $ to signify this.
-s, --stdio
   Accepted but does nothing, for compatibility with BSD locate.
-S, --statistics
   Print various statistics about each locate database and then
   exit without performing a search, unless non-option arguments
   are given. For compatibility with BSD, -S is accepted as a syn-
   onym for --statistics. However, the output of locate -S is dif-
   ferent for the GNU and BSD implementations of locate.
--help
   Print a summary of the options to locate and exit.
--version
   Print the version number of locate and exit.

ENVIRONMENT

LOCATE_PATH
   Colon-separated list of databases to search. If the value has a
   leading or trailing colon, or has two colons in a row, you may
   get results that vary between different versions of locate.

SEE ALSO
   find(1), locatedb(5), updatedb(1), xargs(1), glob(3), Finding Files
   (on-line in Info, or printed)

BUGS
   The locate database correctly handles filenames containing newlines,
   but only if the system's sort command has a working -z option. If you
   suspect that locate may need to return filenames containing newlines,
   consider using its --null option.
   The best way to report a bug is to use the form at http://savan-
nah.gnu.org/bugs/?group=findutils. The reason for this is that you will then be able to track progress in fixing the problem. Other comments about locate(1) and about the findutils package in general can be sent to the bug-findutils mailing list. To join the list, send email to bug-findutils-request@gnu.org.
Find

NAME
find - search for files in a directory hierarchy

SYNOPSIS
find [-H] [-L] [-P] [path...] [expression]

DESCRIPTION
This manual page documents the GNU version of find. GNU find searches the directory tree rooted at each given file name by evaluating the given expression from left to right, according to the rules of precedence (see section OPERATORS), until the outcome is known (the left hand side is false for and operations, true for or), at which point find moves on to the next file name.

If you are using find in an environment where security is important (for example if you are using it to search directories that are writable by other users), you should read the "Security Considerations" chapter of the findutils documentation, which is called Finding Files and comes with findutils. That document also includes a lot more detail and discussion than this manual page, so you may find it a more useful source of information.

OPTIONS
The `-H', `-L' and `-P' options control the treatment of symbolic links. Command-line arguments following these are taken to be names of files or directories to be examined, up to the first argument that begins with `-', `(', `)', `:', or `!'. That argument and any following arguments are taken to be the expression describing what is to be searched for. If no paths are given, the current directory is used.

If no expression is given, the expression `~print' is used (but you should probably consider using `~print0' instead, anyway).

This manual page talks about `options' within the expression list. These options control the behaviour of find but are specified immediately after the last path name. The three `real' options `-H', `-L' and `-P' must appear before the first path name, if at all.

-P  Never follow symbolic links. This is the default behaviour.

   When find examines or prints information a file, and the file is a symbolic link, the information used shall be taken from the properties of the symbolic link itself.

-L  Follow symbolic links. When find examines or prints information about files, the information used shall be taken from the properties of the file to which the link points, not from the link itself (unless it is a broken symbolic link or find is unable to examine the file to which the link points). Use of this option implies -noleaf. If you later use the -P option, -noleaf' will still be in effect. If -L is in effect and find discovers a symbolic link to a subdirectory during its search, the subdirectory pointed to by the symbolic link will be searched.

When the -L option is in effect, the -type predicate will always
match against the type of the file that a symbolic link points to rather than the link itself (unless the symbolic link is broken). Using -L causes the -iname and -ilname predicates always to return false.

-H  Do not follow symbolic links, except while processing the command line arguments. When find examines or prints information about files, the information used shall be taken from the properties of the symbolic link itself. The only exception to this behaviour is when a file specified on the command line is a symbolic link, and the link can be resolved. For that situation, the information used is taken from whatever the link points to (that is, the link is followed). The information about the link itself is used as a fallback if the file pointed to by the symbolic link cannot be examined. If -H is in effect and one of the paths specified on the command line is a symbolic link to a directory, the contents of that directory will be examined (though of course -maxdepth 0 would prevent this).

If more than one of -H, -L and -P is specified, each overrides the others; the last one appearing on the command line takes effect. Since it is the default, the -P option should be considered to be in effect unless either -H or -L is specified.

GNU find frequently stats files during the processing of the command line itself, before any searching has begun. These options also affect how those arguments are processed. Specifically, there are a number of tests that compare files listed on the command line against a file we are currently considering. In each case, the file specified on the command line will have been examined and some of its properties will have been saved. If the named file is in fact a symbolic link, and the -P option is in effect (or if neither -H nor -L were specified), the information used for the comparison will be taken from the properties of the symbolic link. Otherwise, it will be taken from the properties of the file the link points to. If find cannot follow the link (for example because it has insufficient privileges or the link points to a nonexistent file) the properties of the link itself will be used.

When the -H or -L options are in effect, any symbolic links listed as the argument of -newer will be dereferenced, and the timestamp will be taken from the file to which the symbolic link points. The same consideration applies to -anewer and -cnewer.

The -follow option has a similar effect to -L, though it takes effect at the point where it appears (that is, if -L is not used but -follow is, any symbolic links appearing after -follow on the command line will be dereferenced, and those before it will not).

**EXPRESSIONS**

The expression is made up of options (which affect overall operation rather than the processing of a specific file, and always return true), tests (which return a true or false value), and actions (which have side effects and return a true or false value), all separated by operators. -and is assumed where the operator is omitted.
If the expression contains no actions other than -prune, -print is performed on all files for which the expression is true.

OPTIONS
All options always return true. Except for -follow and -daystart, they always take effect, rather than being processed only when their place in the expression is reached. Therefore, for clarity, it is best to place them at the beginning of the expression. A warning is issued if you don’t do this.

-daystart
Measure times (for -amin, -atime, -cmin, -ctime, -mtime, and -mtime) from the beginning of today rather than from 24 hours ago. This option only affects tests which appear later on the command line.

-depth Process each directory’s contents before the directory itself.
-d A synonym for -depth, for compatibility with FreeBSD, NetBSD, MacOS X, and OpenBSD.

-follow Deprecated: use the -L option instead. Dereference symbolic links. Implies -noleaf. The -follow option affects only those tests which appear after it on the command line. Unless the -H or -L option has been specified, the position of the -follow option changes the behaviour of the -newer predicate: any files listed as the argument of -newer will be dereferenced if they are symbolic links. The same consideration applies to -anewer and -cnewer. Similarly, the -type predicate will always match against the type of the file that a symbolic link points to rather than the link itself. Using -follow causes the -iname and -llname predicates always to return false.

-help, --help
Print a summary of the command-line usage of find and exit.

-ignore_readdir_race
Normally, find will emit an error message when it fails to stat a file. If you give this option and a file is deleted between the time find reads the name of the file from the directory and the time it tries to stat the file, no error message will be issued. This also applies to files or directories whose names are given on the command line. This option takes effect at the time the command line is read, which means that you cannot search one part of the filesystem with this option on and part of it with this option off (if you need to do that, you will need to issue two find commands instead, one with the option and one without it).

-maxdepth levels
Descend at most levels (a non-negative integer) levels of directories below the command line arguments. `-maxdepth 0’ means only apply the tests and actions to the command line arguments.

-mindepth levels
Do not apply any tests or actions at levels less than levels (a
non-negative integer). `-mindepth 1' means process all files except the command line arguments.

-mount Don't descend directories on other filesystems. An alternate name for -xdev, for compatibility with some other versions of find.

-noignore_readdir_race

Turns off the effect of -ignore_readdir_race.

-noleaf

Do not optimize by assuming that directories contain 2 fewer subdirectories than their hard link count. This option is needed when searching filesystems that do not follow the Unix directory-link convention, such as CD-ROM or MS-DOS filesystems or AFS volume mount points. Each directory on a normal Unix filesystem has at least 2 hard links: its name and its '.' entry. Additionally, its subdirectories (if any) each have a '...' entry linked to that directory. When find is examining a directory, after it has statted 2 fewer subdirectories than the directory's link count, it knows that the rest of the entries in the directory are non-directories ('leaf' files in the directory tree). If only the files' names need to be examined, there is no need to stat them; this gives a significant increase in search speed.

-regextype type

Changes the regular expression syntax understood by -regex and -iregex tests which occur later on the command line. Currently-implemented types are emacs (this is the default), posix-awk, posix-basic, posix-egrep and posix-extended.

-version, --version

Print the find version number and exit.

-warn, -nowarn

Turn warning messages on or off. These warnings apply only to the command line usage, not to any conditions that find might encounter when it searches directories. The default behaviour corresponds to -warn if standard input is a tty, and to -nowarn otherwise.

-xdev Don't descend directories on other filesystems.

TESTS

Numeric arguments can be specified as
+n for greater than n,
-n for less than n,
n for exactly n.

-amin n

File was last accessed n minutes ago.

-anewer file

File was last accessed more recently than file was modified. If file is a symbolic link and the -H option or the -L option is in effect, the access time of the file it points to is always used.

-atime n
File was last accessed n*24 hours ago. When find figures out how many 24-hour periods ago the file was last accessed, any fractional part is ignored, so to match -atime +1, a file has to have been accessed at least two days ago.

-cmin n
File's status was last changed n minutes ago.

cnewer file
File's status was last changed more recently than file was modified. If file is a symbolic link and the -H option or the -L option is in effect, the status-change time of the file it points to is always used.

-ctime n
File's status was last changed n*24 hours ago. See the comments for -atime to understand how rounding affects the interpretation of file status change times.

-empty File is empty and is either a regular file or a directory.

-false Always false.

-fstype type
File is on a filesystem of type type. The valid filesystem types vary among different versions of Unix; an incomplete list of filesystem types that are accepted on some version of Unix or another is: ufs, 4.2, 4.3, nfs, tmp, mfs, S51K, S52K. You can use -printf with the %F directive to see the types of your filesystems.

-gid n File's numeric group ID is n.

-group gname
File belongs to group gname (numeric group ID allowed).

-iname pattern
Like -iname, but the match is case insensitive. If the -L option or the -follow option is in effect, this test returns false unless the symbolic link is broken.

-iname pattern
Like -iname, but the match is case insensitive. For example, the patterns `fo*' and `F??' match the file names `Foo', `FOO', `foo', `fOo', etc. In these patterns, unlike filename expansion, an initial `.' can be matched by `*'. That is, find -name *bar will match the file `.foobar'. Please note that you should quote patterns as a matter of course, otherwise the shell will expand any wildcard characters in them.

-inum n
File has inode number n. It is normally easier to use the -samefile test instead.

-ipath pattern
Behaves in the same way as -iwholename. This option is deprecated, so please do not use it.

-iregex pattern
Like -regex, but the match is case insensitive.

-iwholename pattern
Like -wholename, but the match is case insensitive.

-links n
File has n links.

-lname pattern
File is a symbolic link whose contents match shell pattern pattern. The metacharacters do not treat \'/\' or \'.\' specially. If the -L option or the -follow option is in effect, this test returns false unless the symbolic link is broken.

-mmin n
File's data was last modified n minutes ago.

-mtime n
File's data was last modified n*24 hours ago. See the comments for -atime to understand how rounding affects the interpretation of file modification times.

-name pattern
Base of file name (the path with the leading directories removed) matches shell pattern pattern. The metacharacters (*, ?, and [^]) match a . at the start of the base name (this is a change in findutils-4.2.2; see section STANDARDS CONFORMANCE below). To ignore a directory and the files under it, use -prune; see an example in the description of -wholename. Braces are not recognised as being special, despite the fact that some shells including Bash imbue braces with a special meaning in shell patterns. The filename matching is performed with the use of the fnmatch(3) library function. Don't forget to enclose the pattern in quotes in order to protect it from expansion by the shell.

-newer file
File was modified more recently than file. If file is a symbolic link and the -H option or the -L option is in effect, the modification time of the file it points to is always used.

-nouser
No user corresponds to file's numeric user ID.

-nogroup
No group corresponds to file's numeric group ID.

-path pattern
See -wholename. The predicate -path is also supported by HP-UX find.

-perm mode
File's permission bits are exactly mode (octal or symbolic). Since an exact match is required, if you want to use this form for symbolic modes, you may have to specify a rather complex mode string. For example '-perm g=w' will only match files which have mode 0020 (that is, ones for which group write permission is the only permission set). It is more likely that you will want to use the \'r\' or \'-' forms, for example '-perm -g=w', which matches any file with group write permission. See the EXAMPLES section for some illustrative examples.
-perm -mode
All of the permission bits mode are set for the file. Symbolic modes are accepted in this form, and this is usually the way in which you would want to use them. You must specify 'u', 'g' or 'o' if you use a symbolic mode. See the EXAMPLES section for some illustrative examples.

-perm /mode
Any of the permission bits mode are set for the file. Symbolic modes are accepted in this form. You must specify 'u', 'g' or 'o' if you use a symbolic mode. See the EXAMPLES section for some illustrative examples. If no permission bits in mode are set, this test currently matches no files. However, it will soon be changed to match any file (the idea is to be more consistent with the behavior of perm -000).

-perm +mode
Deprecated, old way of searching for files with any of the permission bits in mode set. You should use -perm /mode instead. Trying to use the '+' syntax with symbolic modes will yield surprising results. For example, '+u+x' is a valid symbolic mode (equivalent to +u, +x, i.e. 0111) and will therefore not be evaluated as -perm +mode but instead as the exact mode specifier -perm mode and so it matches files with exact permissions 0111 instead of files with any execute bit set. If you found this paragraph confusing, you're not alone - just use -perm /mode. This form of the -perm test is deprecated because the POSIX specification requires the interpretation of a leading '+' as being part of a symbolic mode, and so we switched to using '/' instead.

-regex pattern
File name matches regular expression pattern. This is a match on the whole path, not a search. For example, to match a file named `.fubar3', you can use the regular expression `.f.*bar.*3', but not `f.*r3'. The regular expressions understood by find are by default Emacs Regular Expressions, but this can be changed with the -regextype option.

-samefile name
File refers to the same inode as name. When -L is in effect, this can include symbolic links.

-size n[cwbkMG]
File uses n units of space. The following suffixes can be used:
  `b' for 512-byte blocks (this is the default if no suffix is used)
  `c' for bytes
  `w' for two-byte words
  `k' for Kilobytes (units of 1024 bytes)
  `M' for Megabytes (units of 1048576 bytes)
  `G' for Gigabytes (units of 1073741824 bytes)
The size does not count indirect blocks, but it does count blocks in sparse files that are not actually allocated. Bear in mind that the `\%k' and `\%b' format specifiers of `\-printf' handle sparse files differently. The `\b' suffix always denotes 512-byte blocks and never 1 Kilobyte blocks, which is different to the behaviour of `-ls.

-true
Always true.

-type c
File is of type c:
- b  block (buffered) special
- c  character (unbuffered) special
- d  directory
- p  named pipe (FIFO)
- f  regular file
- l  symbolic link; this is never true if the `-L' option or the `-follow' option is in effect, unless the symbolic link is broken. If you want to search for symbolic links when `-L' is in effect, use `-xtype'.
- s  socket
- D  door (Solaris)

-uid n  File's numeric user ID is n.

-used n
File was last accessed n days after its status was last changed.

-user uname
File is owned by user uname (numeric user ID allowed).

-wholename pattern
File name matches shell pattern pattern. The metacharacters do not treat `/' or `\' specially; so, for example,

find . `-wholename` `./sr*sc'

will print an entry for a directory called `./src/misc' (if one exists). To ignore a whole directory tree, use `-prune' rather than checking every file in the tree. For example, to skip the directory `src/emacs' and all files and directories under it, and print the names of the other files found, do something like this:

find . `-wholename` `./src/emacs' -prune -o -print

-xtype c
The same as `-type' unless the file is a symbolic link. For symbolic links: if the `-H' or `-P' option was specified, true if the file is a link to a file of type c; if the `-L' option has been given, true if c is `\l'. In other words, for symbolic links, `-xtype' checks the type of the file that `-type' does not check.

ACTIONS
-delete
Delete files; true if removal succeeded. If the removal failed, an error message is issued. Use of this action automatically turns on the `-depth' option.
-exec command ;
   Execute command; true if 0 status is returned. All following arguments to find are taken to be arguments to the command until an argument consisting of `\'; is encountered. The string `\{}' is replaced by the current file name being processed everywhere it occurs in the arguments to the command, not just in arguments where it is alone, as in some versions of find. Both of these constructions might need to be escaped (with a `\') or quoted to protect them from expansion by the shell. See the EXAMPLES section for examples of the use of the `-exec' option. The specified command is run once for each matched file. The command is executed in the starting directory. There are unavoidable security problems surrounding use of the `-exec' option; you should use the -execdir option instead.

-exec command { } +
   This variant of the `-exec' option runs the specified command on the selected files, but the command line is built by appending each selected file name at the end; the total number of invocations of the command will be much less than the number of matched files. The command line is built in much the same way that `xargs' builds its command lines. Only one instance of `\{}' is allowed within the command. The command is executed in the starting directory.

-execdir command ;
-execdir command { } +
   Like `-exec', but the specified command is run from the subdirectory containing the matched file, which is not normally the directory in which you started find. This is a much more secure method for invoking commands, as it avoids race conditions during resolution of the paths to the matched files. As with the `-exec' option, the `+' form of `-execdir' will build a command line to process more than one matched file, but any given invocation of command will only list files that exist in the same subdirectory. If you use this option, you must ensure that your $PATH environment variable does not reference the current directory; otherwise, an attacker can run any commands they like by leaving an appropriately-named file in a directory in which you will run `-execdir'.

-fls file
   True: like `-ls' but write to file like `-print'. The output file is always created, even if the predicate is never matched. See the UNUSUAL FILENAMES section for information about how unusual characters in filenames are handled.

-fprint file
   True; print the full file name into file file. If file does not exist when find is run, it is created; if it does exist, it is truncated. The file names `~/dev/stdout' and `~/dev/stderr' are handled specially; they refer to the standard output and
standard error output, respectively. The output file is always created, even if the predicate is never matched. See the UNUSUAL FILENAMES section for information about how unusual characters in filenames are handled.

-fprint0 file
True; like -print0 but write to file like -fprint. The output file is always created, even if the predicate is never matched. See the UNUSUAL FILENAMES section for information about how unusual characters in filenames are handled.

-fprintf file format
True; like -printf but write to file like -fprint. The output file is always created, even if the predicate is never matched. See the UNUSUAL FILENAMES section for information about how unusual characters in filenames are handled.

-ok command ;
Like -exec but ask the user first (on the standard input); if the response does not start with `y' or `Y', do not run the command, and return false. If the command is run, its standard input is redirected from /dev/null.

-print True; print the full file name on the standard output, followed by a newline. If you are piping the output of find into another program and there is the faintest possibility that the files which you are searching for might contain a newline, then you should seriously consider using the `-print0' option instead of `-print'. See the UNUSUAL FILENAMES section for information about how unusual characters in filenames are handled.

-okdir command ;
Like -execdir but ask the user first (on the standard input); if the response does not start with `y' or `Y', do not run the command, and return false. If the command is run, its standard input is redirected from /dev/null.

-print0
True; print the full file name on the standard output, followed by a null character (instead of the newline character that `-print' uses). This allows file names that contain newlines or other types of white space to be correctly interpreted by programs that process the find output. This option corresponds to the `\-0' option of xargs.

-printf format
True; print format on the standard output, interpreting `\' escapes and `%' directives. Field widths and precisions can be specified as with the `printf' C function. Please note that many of the fields are printed as %s rather than %d, and this may mean that flags don't work as you might expect. This also means that the `-f' flag does work (it forces fields to be left-aligned). Unlike -print, -printf does not add a newline at the end of the string. The escapes and directives are:
\a Alarm bell.
\b Backspace.
\c Stop printing from this format immediately and flush the output.
\f Form feed.
\n Newline.
\r Carriage return.
\t Horizontal tab.
\v Vertical tab.
\ ASCII NUL.
\ A literal backslash (\).
\NNN The character whose ASCII code is NNN (octal).
A `\' character followed by any other character is treated as an ordinary character, so they both are printed.
\% A literal percent sign.
%a File's last access time in the format returned by the C `time' function.
%Ak File's last access time in the format specified by k, which is either @ or a directive for the C `strftime' function. The possible values for k are listed below; some of them might not be available on all systems, due to differences in `strftime' between systems.
@ seconds since Jan. 1, 1970, 00:00 GMT.

**Time fields:**

- H hour (00..23)
- I hour (01..12)
- k hour (0..23)
- l hour (1..12)
- M minute (00..59)
- p locale's AM or PM
- r time, 12-hour (hh:mm:ss [AP]M)
- S second (00..61)
- T time, 24-hour (hh:mm:ss)
- + Date and time, separated by '+', for example `2004-04-28+22:22:05'. The time is given in the current timezone (which may be affected by setting the TZ environment variable). This is a GNU extension.
- X locale's time representation (H:M:S)
- Z time zone (e.g., EDT), or nothing if no time zone is determinable

**Date fields:**

- a locale's abbreviated weekday name (Sun..Sat)
- A locale's full weekday name, variable length (Sunday..Saturday)
- b locale's abbreviated month name (Jan..Dec)
- B locale's full month name, variable length (January..December)
c      locale's date and time (Sat Nov 04 12:02:33 EST 1989)
d      day of month (01..31)
D      date (mm/dd/yy)
h      same as b
j      day of year (001..366)
m      month (01..12)
U      week number of year with Sunday as first day of week (00..53)
w      day of week (0..6)
W      week number of year with Monday as first day of week (00..53)
x      locale's date representation (mm/dd/yy)
y      last two digits of year (00..99)
Y      year (1970...)
%b      The amount of disk space used for this file in 512-byte blocks. Since disk space is allocated in multiples of the filesystem block size this is usually greater than %s/1024, but it can also be smaller if the file is a sparse file.
%c      File's last status change time in the format returned by the C `ctime` function.
%ck      File's last status change time in the format specified by k, which is the same as for %A.
%d      File's depth in the directory tree; 0 means the file is a command line argument.
%D      The device number on which the file exists (the st_dev field of struct stat), in decimal.
%f      File's name with any leading directories removed (only the last element).
%F      Type of the filesystem the file is on; this value can be used for -fstype.
%g      File's group name, or numeric group ID if the group has no name.
%G      File's numeric group ID.
%h      Leading directories of file's name (all but the last element). If the file name contains no slashes (since it is in the current directory) the %h specifier expands to "...
%H      Command line argument under which file was found.
%i      File's inode number (in decimal).
%k      The amount of disk space used for this file in 1K blocks. Since disk space is allocated in multiples of the filesystem block size this is usually greater than %s/1024, but it can also be smaller if the file is a sparse file.
%l      Object of symbolic link (empty string if file is not a symbolic link).
%m      File's permission bits (in octal). This option uses the
‘traditional’ numbers which most Unix implementations use, but if your particular implementation uses an unusual ordering of octal permissions bits, you will see a difference between the actual value of the file’s mode and the output of `%m`. Normally you will want to have a leading zero on this number, and to do this, you should use the # flag (as in, for example, ‘%#m’).

%M File’s permissions (in symbolic form, as for ls). This directive is supported in findutils 4.2.5 and later.

%n Number of hard links to file.

%p File’s name.

%P File’s name with the name of the command line argument under which it was found removed.

%s File’s size in bytes.

%t File’s last modification time in the format returned by the C ‘ctime’ function.

%Tk File’s last modification time in the format specified by k, which is the same as for %A.

%u File’s user name, or numeric user ID if the user has no name.

%U File’s numeric user ID.

%y File’s type (like in ls -l), U=unknown type (shouldn’t happen)

%Y File’s type (like %y), plus follow symlinks: L=loop, N=nonexistent

A ‘%’ character followed by any other character is discarded (but the other character is printed).

The %m and %d directives support the # , 0 and + flags, but the other directives do not, even if they print numbers. Numeric directives that do not support these flags include G, U, b, D, k and n. The ‘-’ format flag is supported and changes the alignment of a field from right-justified (which is the default) to left-justified.

See the UNUSUAL FILENAMES section for information about how unusual characters in filenames are handled.

-prune If -depth is not given, true; if the file is a directory, do not descend into it.
If -depth is given, false; no effect.

-quit Exit immediately. No child processes will be left running, but no more paths specified on the command line will be processed.
For example, find /tmp/foo /tmp/bar -print -quit will print only /tmp/foo. Any command lines which have been built up with
-execdir ... {} + will be invoked before find exits. The exit status may or may not be zero, depending on whether an error has already occurred.

-Is True; list current file in `ls -dls' format on standard output.
The block counts are of 1K blocks, unless the environment vari-
able POSIXLY_CORRECT is set, in which case 512-byte blocks are used. See the UNUSUAL FILENAMES section for information about how unusual characters in filenames are handled.

UNUSUAL FILENAMES
Many of the actions of find result in the printing of data which is under the control of other users. This includes file names, sizes, modification times and so forth. File names are a potential problem since they can contain any character except '0' and '.'. Unusual characters in file names can do unexpected and often undesirable things to your terminal (for example, changing the settings of your function keys on some terminals). Unusual characters are handled differently by various actions, as described below.

-print0, -fprint0
Always print the exact filename, unchanged, even if the output is going to a terminal.

-ls, -fls
Unusual characters are always escaped. White space, backslash, and double quote characters are printed using C-style escaping (for example '', '"'). Other unusual characters are printed using an octal escape. Other printable characters (for -ls and -fls these are the characters between octal 041 and 0176) are printed as-is.

-printf, -fprintf
If the output is not going to a terminal, it is printed as-is. Otherwise, the result depends on which directive is in use. The directives %D, %F, %g, %G, %H, %Y, and %y expand to values which are not under control of files’ owners, and so are printed as-is. The directives %a, %b, %c, %d, %i, %k, %m, %M, %n, %s, %t, %u and %U have values which are under the control of files’ owners but which cannot be used to send arbitrary data to the terminal, and so these are printed as-is. The directives %f, %h, %l, %p and %P are quoted. This quoting is performed in the same way as for GNU ls. This is not the same quoting mechanism as the one used for -ls and -fls. If you are able to decide what format to use for the output of find then it is normally better to use '0' as a terminator than to use newline, as file names can contain white space and newline characters.

-print, -fprintf
Quoting is handled in the same way as for -printf and -fprintf. If you are using find in a script or in a situation where the matched files might have arbitrary names, you should consider using -printf0 instead of -print.

The -ok and -okdir actions print the current filename as-is. This may change in a future release.

OPERATORS
Listed in order of decreasing precedence:
( expr )
Force precedence.
! expr True if expr is false.
-not expr
    Same as ! expr, but not POSIX compliant.
expr1 expr2
    Two expressions in a row are taken to be joined with an implied "and"; expr2 is not evaluated if expr1 is false.
expr1 -a expr2
    Same as expr1 expr2.
expr1 -and expr2
    Same as expr1 expr2, but not POSIX compliant.
expr1 -o expr2
    Or; expr2 is not evaluated if expr1 is true.
expr1 -or expr2
    Same as expr1 -o expr2, but not POSIX compliant.
expr1 , expr2
    List; both expr1 and expr2 are always evaluated. The value of expr1 is discarded; the value of the list is the value of expr2. The comma operator can be useful for searching for several different types of thing, but traversing the filesystem hierarchy only once. The -fprintf action can be used to list the various matched items into several different output files.

STANDARDS CONFORMANCE

The following options are specified in the POSIX standard (IEEE Std 1003.1, 2003 Edition):
-H     This option is supported.
-L     This option is supported.
-name  This option is supported, but POSIX conformance depends on the POSIX conformance of the system's fnmatch(3) library function. As of findutils-4.2.2, shell metacharacters ('*', '?', ']' or '[') for example) will match a leading '(', because IEEE PASC interpretation 126 requires this. This is a change from previous versions of findutils.
type   Supported. POSIX specifies `b', `c', `d', `l', `p', `f' and `s'. GNU find also supports `D', representing a Door, where the OS provides these.
-ok     Supported. Interpretation of the response is not locale-dependent (see ENVIRONMENT VARIABLES).
-newer Supported. If the file specified is a symbolic link, it is always dereferenced. This is a change from previous behaviour, which used to take the relevant time from the symbolic link; see the HISTORY section below.

Other predicates
    The predicates `mtime', `ctime', `atime', `depth', `group', `links', `nouser', `perm', `print', `prune', `size', `user' and `xdev', are all supported.
The POSIX standard specifies parentheses `(', ')', negation `!' and the
`and' and `or' operators (`-a', `-o').
All other options, predicates, expressions and so forth are extensions beyond the POSIX standard. Many of these extensions are not unique to GNU find, however.
The POSIX standard requires that
  The find utility shall detect infinite loops; that is, entering
    a previously visited directory that is an ancestor of the last
    file encountered. When it detects an infinite loop, find shall
    write a diagnostic message to standard error and shall either
    recover its position in the hierarchy or terminate.
The link count of directories which contain entries which are hard
links to an ancestor will often be lower than they otherwise should be.
This can mean that GNU find will sometimes optimise away the visiting
of a subdirectory which is actually a link to an ancestor. Since find
does not actually enter such a subdirectory, it is allowed to avoid
emitting a diagnostic message. Although this behaviour may be somewhat
confusing, it is unlikely that anybody actually depends on this
behaviour. If the leaf optimisation has been turned off with -oleaf,
the directory entry will always be examined and the diagnostic message
will be issued where it is appropriate. Symbolic links cannot be used
to create filesystem cycles as such, but if the -L option or the -fol-
low option is in use, a diagnostic message is issued when find encoun-
ters a loop of symbolic links. As with loops containing hard links,
the leaf optimisation will often mean that find knows that it doesn't
need to call stat() or chdir() on the symbolic link, so this diagnostic
is frequently not necessary.
The -d option is supported for compatibility with various BSD systems,
but you should use the POSIX-compliant option -depth instead.
The POSIXLY_CORRECT environment variable does not affect the behaviour
of the -regex or -iregex tests because those tests aren't specified in
the POSIX standard.
ENVIRONMENT VARIABLES
LANG Provides a default value for the internationalization variables
that are unset or null.
LC_ALL If set to a non-empty string value, override the values of all
the other internationalization variables.
LC_COLLATE
  The POSIX standard specifies that this variable affects the pattern
  matching to be used for the `name' option. GNU find uses
  the fnmatch() library function, and so support for `LC_COLLATE'
  depends on the system library.
POIX also specifies that the `LC_COLLATE' environment variable
  affects the interpretation of the user's response to the query
  issued by `-ok', but this is not the case for GNU find.
LC_CTYPE
  This variable affects the treatment of character classes used
  with the `name' test, if the system's fnmatch() library function
  supports this. It has no effect on the behaviour of the
`-ok' expression.

LC_MESSAGES
Determines the locale to be used for internationalised messages.

NLSPATH
Determines the location of the internationalisation message catalogues.

PATH
Affects the directories which are searched to find the executables invoked by `-exec', `-execdir', `-ok' and `-okdir'.

POSIXLY_CORRECT
Determines the block size used by `-ls' and `-lls'. If `POSIXLY_CORRECT' is set, blocks are units of 512 bytes. Otherwise they are units of 1024 bytes.

TZ
Affects the time zone used for some of the time-related format directives of `-printf' and `-fprintf'.

EXAMPLES

```
find /tmp -name core -type f -printf | xargs /bin/rm -f
```
Find files named core in or below the directory /tmp and delete them. Note that this will work incorrectly if there are any filenames containing newlines, single or double quotes, or spaces.

```
find /tmp -name core -type f -printf0 | xargs -0 /bin/rm -f
```
Find files named core in or below the directory /tmp and delete them, processing filenames in such a way that file or directory names containing single or double quotes, spaces or newlines are correctly handled. The `-name' test comes before the `-type' test in order to avoid having to call stat(2) on every file.

```
find . -type f -exec file '{}';
```
Runs `file' on every file in or below the current directory. Notice that the braces are enclosed in single quote marks to protect them from interpretation as shell script punctuation. The semicolon is similarly protected by the use of a backslash; though `;'; could have been used in that case also.

```
find / -perm -4000 -printf /root/suid.txt '%#m %u %p\n' \, / -size +100M -printf /root/big.txt '%-10s %p\n')
```
Traverse the filesystem just once, listing setuid files and directories into /root/suid.txt and large files into /root/big.txt.

```
find $HOME -mtime 0
```
Search for files in your home directory which have been modified in the last twenty-four hours. This command works this way because the time since each file was last modified is divided by 24 hours and any remainder is discarded. That means that to match -mtime 0, a file will have to have a modification in the past which is less than 24 hours ago.

```
find . -perm 664
```
Search for files which have read and write permission for their owner, and group, but which other users can read but not write to. Files which meet these criteria but have other permissions bits set (for example if someone can execute the file) will not be matched.
find . -perm -664
Search for files which have read and write permission for their owner and group, and which other users can read, without regard to the presence of any extra permission bits (for example the executable bit). This will match a file which has mode 0777, for example.
find . -perm /222
Search for files which are writable by somebody (their owner, or their group, or anybody else).
find . -perm /220
find . -perm /u+w,g+w
find . -perm /u=w,g=w
All three of these commands do the same thing, but the first one uses the octal representation of the file mode, and the other two use the symbolic form. These commands all search for files which are writable by either their owner or their group. The files don't have to be writable by both the owner and group to be matched; either will do.
find . -perm -220
find . -perm -g+w,u+w
Both these commands do the same thing: search for files which are writable by both their owner and their group.
find . -perm -444 -perm /222 ! -perm /111
find . -perm -a+r ! -perm /a+w ! -perm /a+x
These two commands both search for files that are readable for everybody (-perm -444 or -perm -a+r), have at least on write bit set (-perm /222 or -perm /a+w) but are not executable for anybody (! -perm /111 and ! -perm /a+x respectively)

EXIT STATUS
find exits with status 0 if all files are processed successfully, greater than 0 if errors occur. This is deliberately a very broad description, but if the return value is non-zero, you should not rely on the correctness of the results of find.

SEE ALSO
locate(1), locatedb(5), updatedb(1), xargs(1), chmod(1), fnmatch(3), regex(7), stat(2), lstat(2), ls(1), printf(3), strftime(3), ctime(3), Finding Files (on-line in Info, or printed).

HISTORY
As of findutils-4.2.2, shell metacharacters ('*'. '?' or '[]' for example) used in filename patterns will match a leading '.', because IEEE POSIX interpretation 126 requires this.

NON-BUGS
$ find . -name ".c" -print
find: paths must precede expression
Usage: find [-H] [-L] [-P] [path...] [expression]
This happens because *.c has been expanded by the shell resulting in find actually receiving a command line like this:
find . -name bigram.c code.c frcode.c locate.c -print
That command is of course not going to work. Instead of doing things this way, you should enclose the pattern in quotes:
$ find . -name '*.c' -print

BUGS
The test -perm /000 currently matches no files, but for greater consis-
tency with -perm -000, this will be changed to match all files; this
change will probably be made in early 2006. Meanwhile, a warning mes-
sage is given if you do this.
There are security problems inherent in the behaviour that the POSIX
standard specifies for find, which therefore cannot be fixed. For
example, the -exec action is inherently insecure, and -execdir should
be used instead. Please see Finding Files for more information.
The best way to report a bug is to use the form at http://savann-
ah.gnu.org/bugs/?group=findutils. The reason for this is that you
will then be able to track progress in fixing the problem. Other com-
ments about find(1) and about the findutils package in general can be
sent to the bug-findutils mailing list. To join the list, send email
to bug-findutils-request@gnu.org.
Foremost

NAME
foremost - Recover files using their headers, footers, and data structures

SYNOPSIS

BUILTIN FORMATS
Recover files from a disk image based on file types specified by the user using the -t switch.

jpg Support for the JFIF and Exif formats including implementations used in modern digital cameras.
gif
png
bmp Support for windows bmp format.
avi
exe Support for Windows PE binaries, will extract DLL and EXE files along with their compile times.
mpg Support for most MPEG files (must begin with 0x000001BA)
wav
riff This will extract AVI and RIFF since they use the same file format (RIFF), note faster than running each separately.
wmv Note may also extract -wma files as they have similar format.
mov
pdf
ole This will grab any file using the OLE file structure. This includes PowerPoint, Word, Excel, Access, and StarWriter
doc Note it is more efficient to run OLE as you get more bang for your buck. If you wish to ignore all other ole files then use this.
zip Note is will extract .jar files as well because they use a similar format. Open Office docs are just zip’d XML files so they are extracted as well. These include SXW, SXC, SXI, and SX? for undetermined OpenOffice files. Office 2007 files are also XML based (PPTX,DOCX,XLSX)
rar
txt
ccc C source code detection, note this is primitive and may generate documents other than C code.
all Run all pre-defined extraction methods. [Default if no -t is specified]

DESCRIPTION
Recover files from a disk image based on headers and footers specified by the user.
-h Show a help screen and exit.
-V Show copyright information and exit.
-d Turn on indirect block detection, this works well for Unix file systems.
-T Time stamp the output directory so you don’t have to delete the output dir when running multiple times.
-v Enables verbose mode. This causes more information regarding the current state of the program to be displayed on the screen, and is highly recommended.
-q Enables quick mode. In quick mode, only the start of each sector is searched for matching headers. That is, the header is searched only up to the length of the longest header. The rest of the sector, usually about 500 bytes, is ignored. This mode makes foremost run considerably faster, but it may cause you to miss files that are embedded in other files. For example, using quick mode you will not be able to find JPEG images embedded in Microsoft Word documents.
Quick mode should not be used when examining NTFS file systems. Because NTFS will store small files inside the Master File Table, these files will be missed during quick mode.
-Q Enables Quiet mode. Most error messages will be suppressed.
-w Enables write audit only mode. No files will be extracted.
-a Enables write all headers, perform no error detection in terms of corrupted files.
-b number
   Allows you to specify the block size used in foremost. This is relevant for file naming and quick searches. The default is 512. ie. foremost -b 1024 image.dd
-k number
   Allows you to specify the chunk size used in foremost. This can improve speed if you have enough RAM to fit the image in. It reduces the checking that occurs between chunks of the buffer. For example if you had > 500MB of RAM. ie. foremost -k 500 image.dd
-i file
   The file is used as the input file. If no input file is specified or the input file cannot be read then stdin is used.
-o directory
   Recovered files are written to the directory directory.
-c file
   Sets the configuration file to use. If none is specified, the file "foremost.conf" from the current directory is used, if that doesn’t exist then "/etc/foremost.conf" is used. The format for the configuration file is described in the default configuration file included with this program. See the CONFIGURATION FILE section below for more information.
-s number
   Skips number blocks in the input file before beginning the search for headers. ie. foremost -s 512 -t jpeg -i /dev/hda1
CONFIGURATION FILE

The configuration file is used to control what types of files foremost searches for. A sample configuration file, foremost.conf, is included with this distribution. For each file type, the configuration file describes the file’s extension, whether the header and footer are case sensitive, the maximum file size, and the header and footer for the file. The footer field is optional, but header, size, case sensitivity, and extension are not!

Any line that begins with a pound sign is considered a comment and ignored. Thus, to skip a file type just put a pound sign at the beginning of that line.

Headers and footers are decoded before use. To specify a value in hexadecimal use \x{0-f}, and for octal use \[1-9][1-9][1-9]. Spaces can be represented by \s. Example: "\x4F\x23\xsCCI" decodes to "OSI CCI".

To match any single character (aka a wildcard) use a ?. If you need to search for the ? character, you will need to change the wildcard line *and* every occurrence of the old wildcard character in the configuration file. Do not forget those hex and octal values! ? is equal to \x3f and \063.

There is a sample set of headers in the README file.

EXAMPLES

Search for jpeg format skipping the first 100 blocks
 foremost -s 100 -t jpg -i image.dd

Only generate an audit file, and print to the screen (verbose mode)
 foremost -av image.dd

Search all defined types
 foremost -t all -i image.dd

Search for gif and pdf’s
 foremost -t gif,pdf -i image.dd

Search for office documents and jpeg files in a Unix file system in verbose mode.
 foremost -vd -t ole,jpeg -i image.dd

Run the default case
 foremost image.dd

AUTHORS

Original Code written by Special Agent Kris Kendall and Special Agent Jesse Kornblum of the United States Air Force Office of Special Investigations.

Modification by Nick Mikus a Research Associate at the Naval Postgraduate School Center for Information Systems Security Studies and Research. The modification of Foremost was part of a masters thesis at NPS.

BUGS

When compiling foremost on systems with versions of glibc 2.1.x or older, you will get some (harmless) compiler warnings regarding the implicit declaration of fseeko and ftello. You can safely ignore these
warnings.

REPORTING BUGS
Because Foremost could be used to obtain evidence for criminal prosecutions, we take all bug reports very seriously. Any bug that jeopardizes the forensic integrity of this program could have serious consequences. When submitting a bug report, please include a description of the problem, how you found it, and your contact information.
Send bug reports to:
namikus AT users d0t sf d0t net

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SEE ALSO
There is more information in the README file.
Foremost was originally designed to imitate the functionality of CarvThis, a DOS program written by the Defense Computer Forensics Lab in 1999.

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FOREMOST(8)