UMSDOS HOW-TO
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Umsdos is a linux file system. It provide an alternative to the EXT2 file–system. Its main goal is to achieve easier coexistence with Ms–DOS data by sharing the same partition. This document explain first how to use Umsdos in different configuration, and later explain its operation and try to provide some information letting you decide if it is a good choice for you (see UMSDOS–WHY–TO at the end).

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2. **UMSDOS: Where is it ?**

2.1 **Copyright and License**

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2.2 History

The Umsdos project was started in 1992 and made available to the net in January 1994 as a patch. It was included in the standard kernel distribution in July, starting with kernel 1.1.36.

Umsdos was early adopted in the Slackware distribution even before it was officially included in the official kernel.

Umsdos was improved starting at kernel 1.1.60. Its performance has been dramatically enhanced, especially for writing. Since 1.1.70 (around this), it is stable again.

A major bug was solve in Linux 1.2.2. This bug was causing some grief to users since the beginning (some file were silently renamed, giving the sad impression that they were deleted). Beware that Slackware 2.2 is still shipping release 1.2.1 of the kernel, so has this bug.

2.3 Availability

It is available as a patch for kernel 1.0.x. It is built−in for kernel 1.2. It can be compiled in or load as a module. Beware that for now, if you intend to load umsdos as a module, you must also use the Ms−DOS fs as a module. This come from a limitation in the module system (some symbols are only export when the drivers is installed as a module).

2.4 Distribution supporting it

So far, I think only Slackware does support it. I am surely wrong, so please send me info to correct this.

2.5 Home site

The home site for Umsdos is sunsite.unc.edu. Look in the directory /pub/Linux/system/Filesystems/umsdos.

2.6 Technical documentation

There is quite a lot of documentation about the internal of Umsdos. It is available both in HTML and text format at the same location as the utilities.

As far as I know, the HTML version is not available online on any web site. You must down−load it and "UN−tar" it and read it locally.

2.7 Who wrote it

Jacques Gelinas jacques@solucorp.qc.ca
3. **Umsdos as your root partition**

3.1 The pseudo–root concept.

With *Umsdos*, *Linux* can be installed in a standard DOS partition. *Linux* is then installed as a second (or third) OS in the partition. To avoid name collision (there is maybe a `bin` or `tmp` directory in the drive C: already), *Umsdos* use a smart trick: The pseudo–root.

All *Linux* files are installed in a DOS subdirectory called `linux`, generally `C:\LINUX`. The normal *Linux/Unix* directory structure goes there. So you get:

- `C:\LINUX\BIN`
- `C:\LINUX\ETC`
- `C:\LINUX\LIB`
- `C:\LINUX\ROOT`
- `C:\LINUX\SBIN`
- `C:\LINUX\TMP`
- `C:\LINUX\USR`
- `C:\LINUX\VAR`

When the *Umsdos* boot, it probes for the directory `linux` and then `/linux/etc`. If it exist, it activates the pseudo–root mode.

Mostly, the pseudo–root mode switch the root of the partition to `C:\\LINUX` giving the conventional *Unix* directory layout:

- `/bin`
- `/etc`
- `/lib`
- `/root`
- `/sbin`
- `/tmp`
- `/usr`
- `/var`

To this list, it adds a new one called `DOS`. This one is a virtual directory.
3.2 Things to know about the pseudo-root

- This mode can only be triggered at boot time. There is no way to activate this by a mount command.
- This mechanism is purely a different view of a normal Umsdos file-system. This means that a partition normally used as a root partition can be normally mounted. There won't be any pseudo-root effect. For example, if you boot linux with a maintenance floppy and mount your normal root partition in /mnt, you will find all your linux directory in /mnt/linux/bin, /mnt/linux/etc and so on.

4. Different topics about the operation of Umsdos

4.1 Mount option

You can use the same mount option as for the Ms-DOS file system. The option conv= is questionable on a Umsdos system. I suggest to avoid it. Mostly the option you may want to look at are

- uid=
- gid=
- umask=

Just remember that Umsdos manage non promoted directory the same way as the Ms-DOS file system. The option above will apply globally to all non promoted directory. uid setup the default owner, gid setup the default group and umask setup the default permissions.

4.2 How to set defaults for the root

umssetup was created to provide at run time default ownership for the root partition. For other Umsdos partition, mount option may be used or umssetup. Storing mount option in /etc/fstab is the preferred way for non root partition. Here is an example. Put this in /etc/rc.d/rc.S.

```
/sbin/umssetup -u jack -g group -m 0755 /
```

4.3 To swap or not to swap

Using a swap file is generally slower than a swap partition. It is however much more flexible. You can setup a swap file in a Umsdos partition the same way you do it for any other Linux file systems. For example, to setup a 8 megabytes swap file in the root directory:

```
dd if=/dev/zero bs=1024k count=8 of=/swap
mkswap /swap 8192
sync
swapon /swap
```

Once done, you can put the following line in /etc/fstab

```
/swap swap swap default
```
And the swap file will be activated at each boot (There is generally a "swapon -a" in /etc/rc.d/rc.S).

5. **How to boot a Umsdos system**

5.1 Loadlin

The package lodlin15.tgz available from sunsite.unc.edu in /pub/Linux/system/Bootutils. This utility is particularly suited to boot a Umsdos system. Generally all you need to do is

```
Boot DOS
C:>loadlin x zimage root=D:
```

where zimage is a normal kernel image (compressed) simply copied somewhere in the DOS drive. D: is the DOS drive where you have installed Linux.

5.2 From a floppy

Booting a Umsdos system from a floppy is not different from booting an Ext2 system. You need a kernel zImage file properly initialize to locate your root Umsdos partition. This is generally achieved using the command rdev. The following sequence will initialize a zImage and put it on a floppy.

```
rdev zImage /dev/hda1
rdev -R zImage 0
dd if=zImage bs=8192 of=/dev/fd0
```

If this looks confusing, just format a boot-able DOS floppy and put the following component on it.

- loadlin.exe
- loadlinx.exe
- zimage

and setup the autoexec.bat like this

```
loadlinx zimage rw root=C:
```

5.3 LILO

LILO, the official Linux boot loader can also be used to boot a Umsdos system. I have no experience with it though. Since 1.1.60, it should work. Please email if you know something.

5.4 How to defragment a Umsdos partition

It can be done using any popular DOS tool. There is nothing particular about file produced by Umsdos. And Umsdos do not expect anything particular (directory layout, directory entry sequence, etc...) from the file
system under it.

As far as I know, there is no Linux tool to achieve this.

## 5.5 Advance tricks

_Umsdos_ rely on the `−−linux−.−−−` which rely on the DOS directory. Some users may want to experiment a bit. The utility _udosctl_ part of the umsdos_progs package (containing umssync and umssetup) allows basic directory operation (listing, deletion) independently on the `−−linux−.−−−` and the DOS directory.

### 6. Basic principle

#### 6.1 Introduction

_Umsdos_ map Linux files directly to Ms–DOS files. This is a one for one translation. File content is not manipulated at all. _Umsdos_ only works on names. For special files (links and devices for example), it introduces special management.

For each directory, there is a file named `−−linux−.−−−`.

#### 6.2 _Umsdos_ can replace the Ms–DOS file–system.

_Umsdos_ can be thought as a general purpose superset of the Ms–DOS file system of Linux. In fact this capability or flexibility yields much confusion about _Umsdos_. Here is why. Try to mount a newly formatted DOS floppy like this.

```
mount −t umsdos /dev/fd0 /mnt
```

And do this,

```
ls / >/mnt/LONGFILENAME
ls −l /mnt
```

You will get the following result

```
−rwxr−xr−x 1 root root 302 Apr 14 23:25 longfile
```

So far, it seems that the _Umsdos_ file system does not do much more (in fact nothing at all) than the normal Ms–DOS file system of Linux.

???

#### 6.3 Directory promotion
Pretty unimpressive so far. Here is the trick. Unless promoted a DOS directory will be managed the same way with Umbsdos than the Ms−DOS file−system will. Umbsdos use a special file in each subdirectory to achieve the translation between the extended capabilities (long name, ownership, etc...) of Umbsdos and the limitation of the DOS file−system. This file is invisible to Umbsdos users, but visible when you boot DOS. To avoid cluttering the DOS partition with those file (--linux−.) uselessly, the file is now optional. If absent, Umbsdos behave like Ms−DOS.

When a directory is promoted, any subsequent operation will be done with the full semantic normally available to Unix and Linux users. And all subdirectory created afterward will be silently promoted.

This feature allows you to logically organize your DOS partition into DOS stuff and Linux stuff. It is important to understand that those --linux−. file do take some place (generally 2k per directory). DOS generally use large cluster (as big as 16k for a 500meg partition), so avoiding putting --linux−. everywhere can save your day.

6.4 How to promote: /sbin/umssync

A directory can be promoted any time using /sbin/umssync. It can be used at any time. Promoting a directory do the following operation

- Create a --linux−.
- Establish a one to one relation between the --linux−. and the current content of the directory.

/sbin/umssync maintain an existing --linux−. file. It does not create it from scratch all the time. It simply add missing entries in it (Files created during a DOS session). It will also removed files which do not exist anymore in the DOS directory from the --linux−. umssync gets its name from that. It put --linux−. in sync with the underlying DOS directory.

6.5 Using /sbin/umssync at boot time

It is a good idea to place a call to /sbin/umssync at the end of your /etc/rc.d/rc.S if it's not there. The following command is adequate for most system:

/sbin/umssync -r99 -c -i+ /

The -c option prevent umssync from promoting directories. It will only update existing --linux−.

This command is useful if you access Linux directory during a DOS session. Linux has no efficient way to tell that a directory has been modified by DOS so Umbsdos can't do a umssync operation as needed.

6.6 How to UN−promote

Remove the --linux−. file using DOS. You will be sorry.

6.7 What about files created during a DOS session ?

Unless you use umssync on a directory where files have been added or removed by DOS, you will notice some problems:

6.4 How to promote: /sbin/umssync
It won't crash the system nor it won't cause major problems, only annoyance :-)

- Files created by DOS.
  - They will be invisible in Linux.
  - When trying to create a file with the same name, you will get an error message stating that the file already exist.
  - This creates more confusion that real problem. It does not harm the file system.
- Files deleted by DOS won't cause problem. Umsdos will notice the absence at the first access. A message will be output (and generally written into /var/adm/syslog).

7. **Installation/UN-installation and some tricks**

The installation of a Umsdos is not much different from the installation of an ordinary (Ext2 based) Linux system.

There are two main differences.

### 7.1 The pseudo-root /mnt/linux

The normal steps for an installation are

1. Setting a partition with fdisk and formatting it.
2. Mounting it as /mnt relative to our installation root disk.
3. Copy all packages into /mnt.

With Umsdos, the step 1 is not required (wasn't it the goal of Umsdos not to reformat ?).

It is possible to install a Umsdos system just by copying all packages into /mnt. This will certainly work. But it will create a bunch of subdirectories into your DOS root directory (C:) and you won't like it. This is the reason all Umsdos installation use the pseudo-root. And this is the major difference between a normal Ext2 installation and a Umsdos one: All files are copied into /mnt/linux.

### 7.2 Preparing /mnt/linux

/mnt/linux is not an ordinary directory. It has to be promoted so it will correctly handle Linux long file name and special files (links, device). The step required to setup /mnt/linux are:

1. `mkdir /mnt/linux`
2. `umssync /mnt/linux`

That's it!

### 7.3 Making sure /mnt/linux is correctly setup

Even if the setup of /mnt/linux is pretty simple, there are many installation package out there who get it wrong. How can ?

The biggest installation problem come from an incompatible umssync program. Umsdos has been update in
linux 1.1.88 (Can't remember exactly) and a flaw was uncovered in umssync. To avoid confusion in the Linux community, it was decided to raise the compatibility level required for all Umsdos tools. Old version of the tools were simply rejected.

It sounds like many distribution did not update their umssync utility on the installation disk.

There are still many distribution like this out there. The net result is that the directory /mnt/linux is not promoted at all and will truncate all long file name and will reject all special file.

It is possible to do a test very early during the installation to find out if something went wrong. Thanks to the pseudo console mechanism of Linux, you can do that without leaving the installation program. Do the following steps:

1. Press Alt−F2 (Alt key at the same time as the F2 key).
2. login as root.
3. cd /mnt/linux If this fail, you are trying this too early. A good time to do this is at the end of the packages selection.
4. >TOTO
5. ls −l You should see an empty file TOTO in uppercase. If you see it in lowercase, something went wrong. Try to do the umssync step again. umssync can be use over and over without problem. umssync . If there is no error message, try the TOTO test again. If TOTO appears fine, then all is OK. Something is strange in this installation, but you just save it. Continue
6. Press Alt−F1 to get back to the installation screen.

If the test fail, the best fix is to get a newer installation root disk. You can generally fix this root disk by installing a newer version of umssync. This is not difficult but required a working Linux system. You simply have to mount the root disk floppy and replace the offending umssync with a new one.

7.4 Oops releasing pseudo root ...

Most Umsdos installation which fail, do this by printing this strange message. This is not a bug in Umsdos although the message looks strange. Here are the known causes.

- The most common one

The Slackware installation try to setup a swap file very early during the installation. To do so, it asks you to select a partition (dos drive), then mount it and set the swap file.

When installing a Slackware system, you must setup the target partition prior to install. This normally mounts the DOS partition on /mnt, creates the /mnt/linux directory and applies umssync on it.

This is where most problems come from. Most user just forget the "setup target partition" step and go directly to the rest of the installation. Since /mnt is already mounted, this mistake goes unnotice. This means that /mnt/linux was not created properly (Not promoted). All special files and links and long names can't be created properly.

- Invalid umssync utility

/mnt/linux was improperly setup-ed. Generally caused by an improper umssync utility on the installation root disk.
• Old bug in umsdos

There was a bug in Umsdos prior to Linux 1.2.2. The pseudo-root mode would not activate properly if the file /etc/init was missing. init is now located in /sbin. You can fix it by getting a newer kernel. This is recommended because another bug was uncover and fixed in 1.2.2.

If you can't upgrade, do this

1. Boot from your installation disk.
2. Login as root.
3. mount -t umsdos /dev/hdXX /mnt where /dev/hdXX is your DOS partition.
4. cd /mnt/linux/etc
5. ln -s ../sbin/init init
6. cd /
7. Ctrl-Alt-Del
8. Boot your Umsdos normally.

Unfortunately, the first two (Installation problems) produce a completely unusable installation. Uninstall it (See next section) and install again.

7.5 How to UN-install a Umsdos system

One neat thing about Umsdos and its pseudo-root mechanism, is that you can UN-install it without pain. You just boot DOS and recursively delete the linux directory. That's all. Umsdos requires no special drivers in the config.sys, nor it creates anything special outside of the linux directory.

7.6 Moving a Umsdos system to another DOS drive

This can be done from Linux or from DOS. You just have to copy recursively the linux directory from one drive to the other. After that you will have to adjust your boot mechanism (generally loadlin command) and the /etc/fstab file.

Umsdos can live on any DOS drive. There is no need to install it on the C: drive, nor it is important to have it on the first hard drive. It does not matter at all.

In fact, one may decide to have several Umsdos installations on different drive just to do experiments.

7.7 About installing 50 Umsdos systems.

How about installing a bunch of Linux systems in no time?

Umsdos systems are living in a DOS world. You can take advantage of this if you wish to install Linux easily.

You can install and configure a Umsdos system at your site. When you are satisfied with the configuration and the different packages you have selected, you can boot DOS and copy the complete linux directory to your DOS file server. Then you go to other DOS station and simply copy the files on the network drive to the local drive. That's it. Only adjust the boot script (Loadlinx) and go.
With minimal adjustment (Host name, IP number), anyone will be able to install a Linux system in a matter of minute.

Interest readers may note that installing Linux systems by copying running system also works for any other Linux systems, including Ext2 based one.

One beauty of Linux is that there is no hidden files which have to be install by magic installation program.

8. **Setting a Linux section in a DOS partition**

_Umsdos_ has some use even for Ext2 (Native Linux file-system) users. One common scenario is this:

- Linux being your OS of choice, the Linux partition start to fill and fill and fill.
- Your DOS partition is collecting dust, being half empty.
- You are suddenly out of space in the Ext2 partition.
- You are still not sure you want to get rid of DOS.

_Umsdos_ may save the day here. You can setup a Linux directory in the DOS partition and use it without restriction for Linux usage. For example, say you want to setup a new directory named "extra" in your C: drive. And you want this directory to behave as a normal Linux directory. Do this (assuming that C: is /dev/hda1).

```bash
mkdir /c
/sbin/mount -t umsdos /dev/hda1 /c
mkdir /c/extra
umssync /c/extra
```

You must be root to do this.

By setting up /etc/fstab like this, you will always have access to the /c/extra directory.

9. **UMSDOS—WHY—TO**

Explaining how to operate or install a _Umsdos_ system is not enough. Most people are seeking some advises about using _Umsdos_ or not.

9.1 **The goal of Umsdos**

The goal of _Umsdos_ was to ease the installation of Linux. An other goal was to ease its UN–installation. The idea here was to promote the spreading of _Linux_. Installing a new OS on a system is always troublesome. _OS/2_ for one will happily pollute your C: root with a bunch of new directories. If you are clever like me, it will also erase your config.sys and autoexec.bat files :-(

The pseudo–root feature of _Umsdos_ avoid this unwanted invasion. _Linux_ can be UN–install without side effect.
9.2 Who needs it

If you have a small hard drive, Umdos will allow you to share disk space between DOS and Linux. A disk below 300 megs is in my opinion a small disk. This opinion is based on the size of the different package available today. One popular word processor may eat as much as 70 megabytes if you select all features.

If you have a larger drive, you may consider having a dedicated Linux partition running the Ext2 file-system. Ext2 use a smaller cluster size that DOS (1k in fact) so installing many small files will eat less space than in a Umdos partition.

9.3 Performance issue

The following point apply to Umdos compared with Ext2.

- Directory management is faster on Ext2. This come from the overhead of the double directory structure of Umdos.
- File access (reading and writing) is probably faster on Umdos than Ext2. This come from the simplicity of the FAT file-system used by DOS. Beware that this simplicity come with a cost:
  - A maximum of around 65,000 files or clusters per partitions. This also means that a 500 megabytes partition will use cluster 16k large. In other word, a file containing a single byte will use 16k of disk storage.
  - Everything is controlled by the FAT located at the beginning of the hard drive. The DOS file-system is probably more fragile because of this.
  - No provision to avoid fragmentation of files. A Umdos system will generally be used as a single user workstation. In this case, this does not matter much. As a multi-user engine, files will get spread-ed all around the drive, lowering file access performance.
- Symbolic links are stored in normal file. If you intend to have a lot of them, you will find that Umdos use quite a lot of disk space compared to Ext2.