DOS Lives!
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Are you nostalgic for the days of DOS? Do you miss making disastrous typos on the command line or trying to find an AUTOEXEC.BAT that will let your PC complete the boot process? There is good news, for you can return to those thrilling days of yesteryear on your present computer with its GigaBytes of RAM, TerraBytes of disk, and obscenely high-definition display, regardless of what operating system you use. You can work with GWBasic or Turbo C and play those old text games, such as Adventure, or those with what passed for graphics, such as Leisure Suit Larry. An easy means of doing this is by using the free program DOSBox, http://www.dosbox.com/, which is available for Windows, OS X, and Linux.

DOSBox can run DOS programs that require the CPU to be in either real or protected mode, independent of its host CPU and operating system. It can emulate many types of display and sound hardware, such as text, CGA, EGA, or VGA for display and the PC speaker, AdLib, or Sound Blaster for sound. Storage is handled by mapping a drive letter in the emulator to a directory, image file, diskette drive, or CDROM drive on the host computer. DOSBox can simulate peer-to-peer or Internet/Intranet networking and is capable of timing-compatible implementation of the serial ports, which can enable older hardware and software dependent on serial port timing to work. Printing can be problematic; you'll probably use screen-shots for graphics and transfer text files to your host for it to print.

DOSBox provides a high-level emulation of the DOS and BIOS interrupts, and contains its own internal DOS-like shell. This means that it can be used without owning a license to any real DOS operating system. However, using copy-protected diskettes or those with non-standard formats is generally not possible.

When you install DOSBox, it creates a configuration file, which doubles as both CONFIG.SYS and AUTOEXEC.BAT. Its name and location vary with operating system; access it in Windows with the sequence *Start > All Programs > DOSBox-0.74 > Options*; in Linux it's located at *~/.dosbox/dosbox-0.74.conf*, and in OS X at *~/Library/Preferences/DOSBox 0.74 Preferences*. Regardless of your OS, you'll need to create a directory that DOSBox will use as a virtual C: hard drive. When first installed it sees only a Z: drive, which is reserved for its internal use. The first time you boot your prompt will be "Z:>:" showing that you are on the Z: drive. To mount the directory you've designated as your C: drive issue the following commands.

    mount C <full pathname of directory>
    C:

You probably want to put these commands in your configuration file so you won't have to retype them every time you start DOSBox. At the end of this file are the following lines. (Those beginning with # are comments.)

```
[autoexec]
# Lines in this section will be run at startup.
# You can put your MOUNT lines here.
```

I've defined two disks on my Linux system, and this section now has seven additional lines to emulate a C: and an A: disk, to modify the search path, and to move to the C: drive.

```
[autoexec]
# Lines in this section will be run at startup.
# You can put your MOUNT lines here.
# Mount C: on /home/n2nd/.dosbox/C_Drive
mount C /home/n2nd/.dosbox/C_Drive
# Mount A: on /home/n2nd/.dosbox/A_Drive
mount A /home/n2nd/.dosbox/A_Drive
# Add Turbo Pascal to path
PATH=Z:\;C:\BIN;C:\TP
C:
```

On a Windows system, lines 4 and 5 above might be the following.

```
# Mount C: on C:\C_Drive
mount C C:\C_Drive
```

Above this section, the configuration file performs the same functions as CONFIG.SYS. The only change I made here was to enlarge the DOSBox window, which by default is 640 by 480 pixels, quite small on modern displays. I changed two lines.

```
windowresolution=original
output=surface
```

into

```
windowresolution=1024x768
output=overlay
```

The first enlarges the window and the second is optional. It speeds up the display and allows scaling, but may not be compatible with all systems. Screen 1 shows the DOSBox boot screen after making these changes.

```
Welcome to DOSBox v0.74

For a short introduction for new users type: INTRO
For supported shell commands type: HELP

To adjust the emulated CPU speed, use ctrl-F11 and ctrl-F12.
To activate the keymapper ctrl-F1.
For more information read the README file in the DOSBox directory.

HAVE FUN!
The DOSBox Team http://www.dosbox.com

Z:\>SET BLASTER=A220 I7 D1 H5 T6

Z:\>mount C /home/n2nd/.dosbox/C_Drive
Drive C is mounted as local directory /home/n2nd/.dosbox/C_Drive/

Z:\>mount A /home/n2nd/.dosbox/A_Drive
Drive A is mounted as local directory /home/n2nd/.dosbox/A_Drive/

Z:\>PATH=Z:\;C:\BIN;C:\TP

Z:\>C:

C:\>
```

Screen 1. DOSBox Boot Screen.

As you can see from the blue welcome message, some help is available (for more detailed information, see the tutorial on the DOSBox Website). The first output line shows the emulated sound card parameters (which you can change) followed by the commands in the AUTOEXEC.BAT portion of the configuration file and their effects.

The uncommented lines from bottom portion of the configuration file are visible within DOSBox as Z:\AUTOEXEC.BAT as Screen 2 shows. However, they can be changed only by editing the configuration file from your computer's operating system. This screen also shows a portion of the help output.

```
C:\>type z:\autoexec.bat
SET BLASTER=A220 I7 D1 H5 T6
mount C /home/n2nd/.dosbox/C_Drive
mount A /home/n2nd/.dosbox/A_Drive
PATH=Z:\;C:\BIN;C:\TP
C:


C:\>help
If you want a list of all supported commands type help /all .
A short list of the most often used commands:
<DIR      > Directory View.
<CD       > Displays/changes the current directory.
<CLS      > Clear screen.
<COPY     > Copy files.
<DEL      > Removes one or more files.
<EXIT     > Exit from the shell.
<MD       > Make Directory.
<RD       > Remove Directory.
<REN      > Renames one or more files.
<TYPE     > Display the contents of a text-file.
<VER      > View and set the reported DOS version.

C:\>
```
Screen 2. Autoexec.bat and Help.

The INTRO command produces several screens of information, the last of which is shown in Screen 3. These commands were not available in the original DOS, but using them can be essential here. For example, some DOS programs were available on several diskettes, and you were required to swap them during the installation. I was able to install such programs by placing the contents of the first diskette on the directory mapped to the DOSBox A: drive and starting the installation. When told to change diskette, I went to my PC's operating system, deleted the contents of this directory and wrote the contents of the second diskette there. Then in DOSBox I typed <CTL><F4> and continued installing. You will also often use <CTL><F10> to capture or release the mouse and <CTL><F9> to close DOSBox.

```
Special keys:
These are the default keybindings.
They can be changed in the keymapper.

ALT-ENTER    : Go full screen and back.
ALT-PAUSE    : Pause DOSBox.
CTRL-F1      : Start the keymapper.
CTRL-F4      : Update directory cache for all drives! Swap mounted disk-image.
CTRL-ALT-F5  : Start/Stop creating a movie of the screen.
CTRL-F5      : Save a screenshot.
CTRL-F6      : Start/Stop recording sound output to a wave file.
CTRL-ALT-F7  : Start/Stop recording of OPL commands.
CTRL-ALT-F8  : Start/Stop the recording of raw MIDI commands.
CTRL-F7      : Decrease frameskip.
CTRL-F8      : Increase frameskip.
CTRL-F9      : Kill DOSBox.
CTRL-F10     : Capture/Release the mouse.
CTRL-F11     : Slow down emulation (Decrease DOSBox Cycles).
CTRL-F12     : Speed up emulation (Increase DOSBox Cycles).
ALT-F12      : Unlock speed (turbo button/fast forward).

C:\>_
```
Screen 3. Special Keys.

Screen 4 shows the software bundled with DOSBox, although there are more commands internal to COMMAND.COM. As you can see, it includes only the basic utilites, but useful (as well as frivolous) DOS software is widely available (for example at Abandonia (http://www.abandonia.com/en) and the Internet Archive (http://archive.org/). A little searching will unearth much more, some free and legal, some at small cost, and a lot of course pirated. You may also have old DOS diskettes, which you can use, provided they aren't copy-protected and you still have a working diskette drive. I had saved a package of Infocom games and was able to download legal copies of Adventure, Leisure Suit Larry, GWBasic, QBasic, Turbo C, and Turbo Pascal. Much of the early DOS software was available only as Basic code, and the system is incomplete without an interpreter to run it. Almost as important, the original manuals for the languages are also available. While it's possible to learn a game by trial and error, this is far from true for a language compiler or interpreter.

```
Z:\>mount D /home/n2nd/.dosbox/D_Drive
Drive D is mounted as local directory /home/n2nd/.dosbox/D_Drive/

Z:\>PATH=Z:\;C:\BIN;C:\TP

Z:\>C:

C:\>dir z:\
Directory of Z:\.
COMMAND  COM                    20 01-10-2002 12:34
AUTOEXEC BAT                   127 01-10-2002 12:34
KEYB     COM                    20 01-10-2002 12:34
IMGMOUNT COM                    20 01-10-2002 12:34
BOOT     COM                    20 01-10-2002 12:34
INTRO    COM                    20 01-10-2002 12:34
RESCAN   COM                    20 01-10-2002 12:34
LOADFIX  COM                    20 01-10-2002 12:34
MEM      COM                    20 01-10-2002 12:34
MOUNT    COM                    20 01-10-2002 12:34
MIXER    COM                    20 01-10-2002 12:34
CONFIG   COM                    20 01-10-2002 12:34
    12 File(s)                 347 Bytes.
     0 Dir(s)                    0 Bytes free.

C:\>_
```
Screen 4. DOSBox External Programs.

Keeping a DOS filesystem organized takes some effort. Both the programs and files
reside in the same area, although experienced DOS users learned to keep them in
separate directories. A key quantity was PATH, which specified where the PC should
look for executable files. When first installed, the DOSBox path is set to Z:\ which is the
directory that holds all the system software. As you can see from Screen 1, I expanded
this only slightly by adding C:\TP (required by Turbo Pascal) and C:\BIN (the directory
that holds my added software).

As I mentioned above, you will probably want to add GWBasic to be able to run early
DOS programs, but more advanced languages were also available, such as QBasic
(which Microsoft began using with MS-DOS 5), Pascal, and C. (By the way, GWBasic
and QBasic programs are incompatible. You may need both to do serious DOS
archeology.) Borland's successor, Embarcadero,
http://cc.embarcadero.com/Default.aspx, now makes both Turbo Pascal and Turbo C
available for free. Screen 5 shows Turbo C with a snippet of code.

```
  File    Edit    Run    Compile    Project    Options    Debug    Break/watch
╔══════════════════════════════════════════ Edit ═══════════════════════════════╗
║      Line 1      Col 1     Insert Indent Tab Fill Unindent     C:HELLO2.C       ║
║#include <stdio.h>                                                               ║
║int main()                                                                       ║
║{                                                                                ║
║printf("Hello World\n");                                                         ║
║printf("Thank You");                                                             ║
║getch();                                                                         ║
║}                                                                                ║
║                                                                                 ║
║                                                                                 ║
║                                                                                 ║
║                                                                                 ║
║                                                                                 ║
║                                                                                 ║
║                                                                                 ║
║                                                                                 ║
║                                                                                 ║
║                                                                                 ║
║─────────────────────────────────── Message ────────────────────────────────────║
║                                                                                 ║
╚═════════════════════════════════════════════════════════════════════════════════╝
  F1-Help  F5-Zoom  F6-Switch  F7-Trace  F8-Step  F9-Make  F10-Menu   NUM
```

Screen 5. Turbo C.

The program is a complete development environment; you can edit, compile, run, and debug your code without ever leaving it. (Turbo Pascal uses the same environment, and those for QBasic and GWBasic are quite similar.) If you're familiar with C, you probably noticed the last statement, which doesn't appear in most hello-world programs. It's needed because when a program ends, you jump back to the development environment. Here getch() causes the program to wait for you to type a character, which means the screen displays the program output until you do that. Without it, you would have to exit the environment to run the program and see what is does.

Many DOS games are text only, and one of the first I played was Adventure; Screen 6 shows this in progress. You'll need a cheat sheet to get very far, but these are also readily available.

```
At End Of Road                                                        36/3
   You are standing at the end of a road before a small brick building.  Around
you is a forest.  A small stream flows out of the building and down a gully.

>enter building
Inside Building

   You are inside a building, a well house for a large spring.

   You see a brass lantern, a small bottle of water, a set of keys, and some
tasty food here.

>take lantern, bottle, keys, food
brass lantern:  Taken.
small bottle of water:  Taken.
set of keys:  Taken.
some tasty food:  Taken.

>exit
At End Of Road

   You are standing at the end of a road before a small brick building.  Around
you is a forest.  A small stream flows out of the building and down a gully.

>_
```

Screen 6. Adventure.

There are many games with crude DOS graphics and tin-whistle music, such as the mildly racy Leisure Suit Larry, shown in Screen 7.

Screen 7. Leisure Suit Larry.

DOXBox is not the only way to return to DOS; there is also the far more complete open-source FreeDOS, http://www.freedos.org/download/, which you can install as a dual-boot alternative to your normal operating system. Although it may be more convenient to install it as a virtual machine, for example using VirtualBox, https://www.virtualbox.org/. Step-by-step instructions for doing this are available at http://wiki.freedos.org/wiki/index.php/VirtualBox. (These are for earlier versions of both programs, but the differences are minor. Just don't expect to see exactly the same screens.) Using this approach allows you to run DOS programs at the same time as your other computing tasks.

FreeDOS is probably overkill for most people, but if you may need it to do serious work in DOS; Screen 8 shows its opening screen.

```
Modules using memory below 1 MB:

   Name           Total            Conventional         Upper Memory
   --------    ----------------    ----------------    ----------------
   SYSTEM      168,368   (164K)     10,496   (10K)     157,872   (154K)
   HIMEMX        2,128    (2K)       2,128    (2K)           0    (0K)
   COMMAND       4,064    (4K)       3,024    (3K)       1,040    (1K)
   UDVD2         2,000    (2K)           0    (0K)       2,000    (2K)
   FDAPM           928    (1K)           0    (0K)         928    (1K)
   SHARE         9,280    (9K)           0    (0K)       9,280    (9K)
   SHSUCDX      11,008   (11K)           0    (0K)      11,008   (11K)
   CTMOUSE       3,104    (3K)           0    (0K)       3,104    (3K)
   Free        649,632  (634K)     638,400  (623K)      11,232   (11K)
   Drives Assigned
Drive   Driver   Unit
   D:    FDCD0001   0
2 drive(s) available.

Done processing startup files C:\FDCONFIG.SYS and C:\AUTOEXEC.BAT

Type HELP to get support on commands and navigation.

Welcome to the FreeDOS 1.2 operating system (http://www.freedos.org)

C:\>_
```

Screen 8. FreeDOS.

Screen 9 shows the commonly-used external DOS commands (those not internal to COMMAND.COM) that are included with the standard installation. As you can see, there are far more than what DOSBox provides.

```
 Alt+X Exit                                               F1 Help on Help

   append          apropos         assign          (atapicdd.sys) attrib
  (backup)         callver         cdrcache.sys    chkdsk         choice
   command         comp            country.sys     cpidos         ctmouse
   debug           defrag          deltree         diskcomp       diskcopy
   display         edit            edlin           (emm386)       exe2bin
   fasthelp        fc              fdapm           fdhelp         fdisk
   fdshield        (fdxms.sys)     (fdxms286.sys)  find           format
   freecom         fsuite04        (gcdrom.sys)    graftabl       graphics
   graphics-ps     help            (himem)         himemx         htmlhelp
   jemm386         jemmex          join            kc             kernel.sys
   kernel-devel    keyb            keycode         keyman         klib
   kpdos           label           lbacache        listxdef       mem
   mirror          mkeyb           mode            (modecon)      more
   move            (mscdex)        nansi.sys       nlsfunc        print
   printer.sys     printq          recover         replace        (restore)
  (scandisk)       scankbd         (setver)        share          shsucdx
   sort            subst           swsubst         sys            tdsk
   tickle          tree            (udma.sys)      (udma2.sys)    (udvd.sys)
   uide.sys        undelete        unformat        whatis         (xcdrom.sys)
   xcopy           (xdma.sys)      xkeyb           xmgr.sys


    ← Back          Alt+F Forward          Alt+C Contents         Alt+S Search
```

Screen 9. FreeDOS Commands.

If you decide to try FreeDOS, be aware that the download includes many applications that aren't installed by default, but reside in the ISO image as ZIP files, which is available as disk D:. Install them with FDIMPLES, as shown in Screen 10.
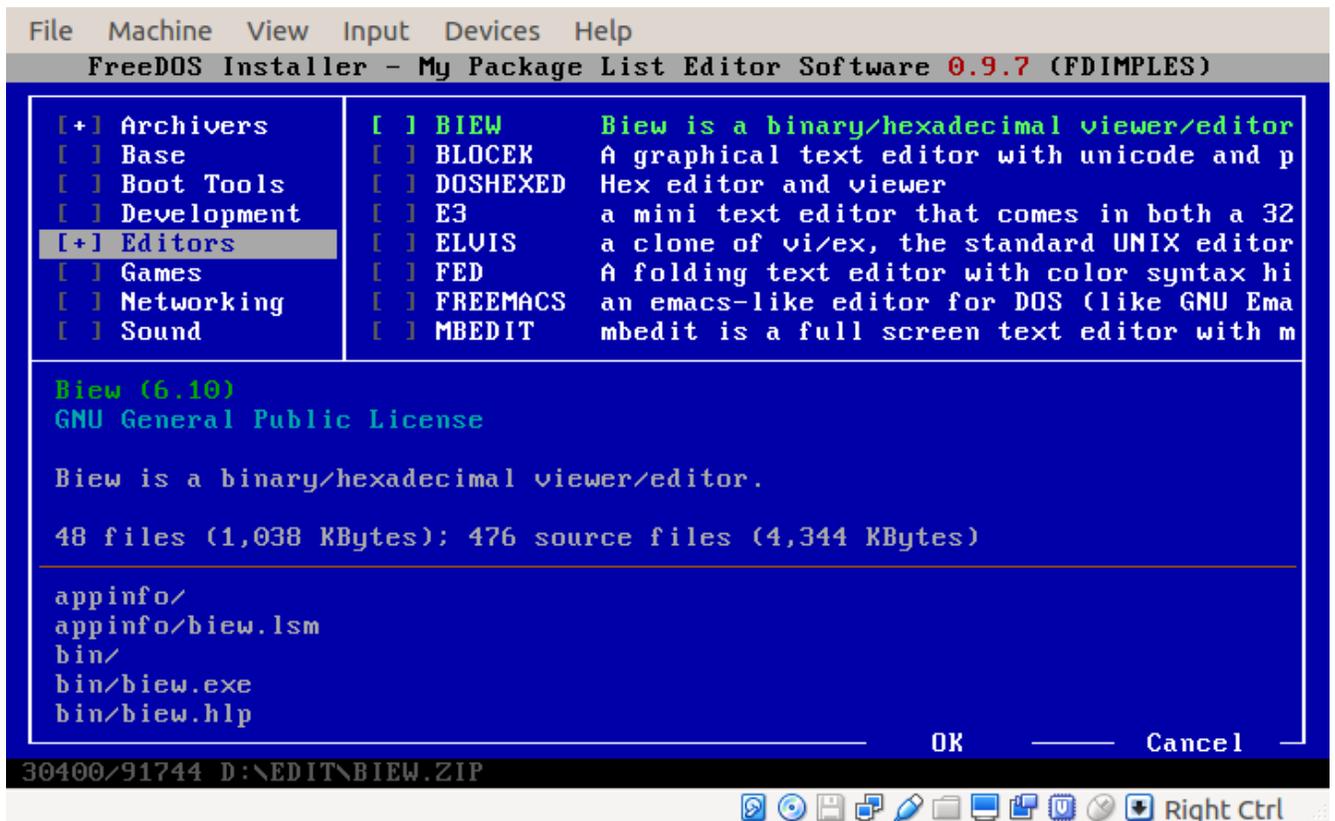
Screen 10. Using FDIMPLES to install additional programs.

However, running it on VirtualBox entails some limitations. You can't drag and drop items from the host OS to FreeDOS while its running, there is no shared disk, and USB devices aren't recognized. The most convenient way to transfer information to your host OS is to set up a virtual network connection, and if FreeDOS is not running, you can transfer files to its virtual disk. (See the manual referenced above.) You can also write to a mounted CD-ROM or ISO file.

As I said, most users will find that DOSBox is entirely satisfactory and more convenient to use than FreeDOS. Both provide a safe way to experiment with DOS. DOSBox can access only the files in the directories you mount as drives. (For this reason, please don't follow the advice in some articles that you should mount your entire C: disk.) FreeDOS can see only the partition on which it's installed (if you dual boot) or on the virtual drive (if you use a virtual machine). Despite these safeguards, prudent users will scan anything they download for malware before they try to use it.

Taking a nostalgic trip back to the 1980s with either of these will surely increase your appreciation of your current computing environment.