Spoilt for choice

Into switching operating systems? Roger Gann takes you through multi-booting.

There is only one thing better than a single operating system on a personal computer and that's several — well, it is possible, but believe me it is not at all straightforward.

The boot process

When an Intel x86-based computer starts, sector 0, or the master boot record (MBR), is loaded from the first hard disk and executed. Sector 0 contains the partition table and some code, sometimes referred to as the master boot code (MBC). This code scans the partition table for the single active partition and loads sector 0 from this partition into memory and executes it. This sector could be a utility, or a diagnostic program, or more likely a boot sector containing boot code for an operating system. The boot code starts the operating system in a manner defined by that operating system.

All multi-boot systems manipulate the MBR in order to select a particular operating system to boot. Different operating systems offer varying degrees of support for multiple hard drives, which can limit your multi-boot options. And since some multi-boot systems are more vulnerable than others, and corruption or loss of the MBR data can render the system unusable, it is always advisable to have a recovery system in place. At the very least this means a bootable DOS disk with the FDISK, FORMAT and SYS commands.

For Windows 9x, NT and OS/2 Warp you should create recovery disks with the provided system utilities. For NT and OS/2 Warp you should also have copies of the original setup diskettes handy.

Partition basics

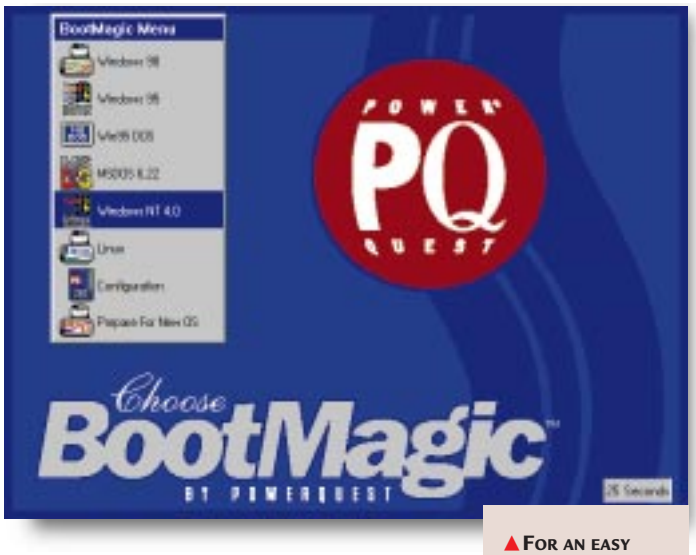
To be bootable, a primary partition must exist on the first physical hard drive and be marked 'active' in the MBR. A hard disk may contain up to four primary partitions but only one can be active at a time and only the active primary partition will be 'visible' to the operating system.

So, it's easy to set up a cheap and cheerful manual multi-boot system. First, create up to four primary partitions using DOS FDISK. Then, make each partition active in turn and format it with FORMAT and install a different operating system on each.

To change to another operating system, you simply boot to a DOS prompt, run FDISK, choose Item 2, 'Set Active Partition' and then select the partition from which you want to boot. You then quit FDISK and reboot. Your OS of choice will now boot.

As already noted, inactive primary partitions become invisible once the PC has booted, so if you had one hard drive partitioned into four primary partitions, then the other three would 'disappear' once you booted any of the operating systems. To 'share' drives and data between operating systems, you'll need to install at least one Extended partition. This can be located either on the first hard disk or subsequent drives.

The next problem concerns file systems and whether they are mutually compatible. Operating systems that recognise and use the same file systems can share partitions; meaning that a user can see files on such partitions from whichever of the operating systems is currently running.



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Sadly, not all operating systems can handle all file systems: Windows 98 has FAT32, NT 4.0 has NTFS, OS/2 Warp 4.0 has HPFS and Linux has ext2. And they're mutually incompatible.

A good place to start would be the lowest common denominator and I guess that would be the DOS FAT16 file system: this is visible to MS-DOS 6.2, Windows 9x, NT 4.0, OS/2 Warp 4.0 and Linux. And, it is possible to install all these operating systems onto FAT16 partitions. The downside is the limitations of FAT16, particularly with regard to large, modern hard disks.

It is possible to get some operating systems to recognise 'foreign' file systems, typically by using third-party drivers (most are available from www.hotfiles.com) although, so far, support for FAT32 seems to be non-existent. For instance, device drivers are available

File System/Operating System compatibility

FS/OS	MS-DOS	Windows 98/FAT32	NT 4.0	OS/2 Warp 4.0	Linux
FAT16	native	✓	✓	✓	✓
FAT32	✗	native	✗	✗	✗
NTFS	✓ (3rd party driver)	✗	native	✗	✓ (3rd party driver)
HPFS	✓ (3rd party driver)	✗	(✓ Windows NT 3.5)	native	✓ (3rd party driver)
Linux ext2	✓ (3rd party driver)	✗	✗	✓ (3rd party driver)	native

which let DOS access NTFS, HPFS and Linux partitions.

Setting up a multi-boot system

Normally, when you install common operating systems like Windows 9x, NT 4.0 and OS/2 Warp, on a PC that already has an operating system installed, the new system will detect this and offer to install a 'dual boot' facility — that is, it will let you choose which operating system to load at boot time.

If your OS needs are modest, this may be all you need to run multiple operating systems on a single PC. Windows 9x is limited in this regard and will dual boot with DOS (although not if you're running a FAT32 file system). If you're running a FAT16 version of Windows 9x, press the F4 key when you see the 'Windows 9X Starting...' message on-screen.

NT 4.0 will support an unlimited number of versions of NT — provided they're installed in different partitions — plus one other operating system. NTLoader displays a list of the available operating systems.

Of the three, OS/2 Warp 4.0 has the most fully-featured multi-boot facility, in the shape of BootManager. This utility lets you install a theoretically unlimited number of operating systems. It's also easy to switch operating systems from the command line: from DOS, the command BOOT/OS2 will reboot the PC into OS/2 Warp, while BOOT/DOS reboots the system into DOS. Uniquely, Warp 4.0 will also let you load and run different operating systems at the same time, typically versions of DOS, in multiple windows, booting them off floppy boot disk 'images'.

Windows 9x

DOS and Windows 95 can only boot from an active primary partition on the first physical drive. Some DOS and Windows 95 system files can be placed on a logical drive but the critical boot files have to be on the active primary.

The dual boot facility of Windows 95 effectively ended with the OSR2 release, which introduced FAT32. Previously, both Windows 95 and DOS used the FAT16 file system. But while the FAT32 system can work with FAT16 partitions, the reverse is not true. It is possible to manually force recent versions of Windows 9x to dual boot by editing the MSDOS .SYS configuration file, but this will only work if both operating systems are on a FAT16 partition. Otherwise, they have to be installed on separate partitions and selected at boot time using a third-party boot manager. Or by using FDISK or third-party offerings like System Commander.

Windows NT 4.0

Windows NT system files can be installed into any partition on any drive, including logical partitions, but the NT boot program must reside on the active primary partition on the first physical drive. It is just about possible to 'triple' boot NT 4.0 or MS-DOS 6.22 or Windows 9x but it requires some nifty footwork on your part.

- **First of all,** install MS-DOS in a FAT16 partition, then install NT 4.0 in the same FAT16 partition. Remove the Read-Only, Hidden and System attributes of Bootsect.dos file by typing the following line from the command prompt:

```
ATTRIB -r -h  s BOOTSECT.DOS <CR>
```

- **Next, copy this file** to another name:

```
COPY C:\BOOTSECT.DOS
C:\BOOTSECT.SAV <CR>
```

- **Boot to MS-DOS** and install Windows 95/98 as normal.

You now have to repair the Windows NT boot sector as Windows 9x will have overwritten the boot sector. It will also create a new BOOTSECT.DOS for Windows 95/98. So, remove the read-only, hidden, and system attributes from the Windows 95/98 BOOTSECT.DOS as before:

```
ATTRIB -R -H -S BOOTSECT.DOS <CR>
```

- **Rename** this file to BOOTSECT.W40. Rename the MS-DOS boot sector from BOOTSECT.SAV to BOOTSECT.DOS.
- **Next,** remove the Read-Only attribute from the Windows NT 4.0 system file, BOOT.INI:

```
ATTRIB -r BOOT.INI <CR>
```

- **Load BOOT.INI** in a text editor like Edit or Notepad and add the two lines:

```
[Operating Systems]
C:\BOOTSECT.DOS="MS-DOS↙
 v6.22" /win95dos
C:\BOOTSECT.W40="Windows↙
 95/98" /win95
```

(Key: ↙ code string continues)

The new switches, /win95dos and /win95, are required so that Windows NT can emulate the multiple boot process of Windows 95/98. Now you should return the Read-Only status to BOOT.INI:

```
ATTRIB +r BOOT.INI <CR>
```

When you reboot, you should now see the additional choices of 'Windows 95/98' and 'MS-DOS v6.22' when you start Windows NT.

Note that if you want to use NTFS and/or FAT32 they will need to be installed in different partitions for each operating system. The ARC path in the BOOT.INI file will need to be modified to reflect the different partitions.

Linux

It is possible to multi-boot Linux with Windows NT 4.0 and Windows 9x *et al*, using the Linux LILO utility but this is a protracted process and space limitations preclude me from describing it. Suffice to say, this procedure is described in gruesome detail at the Linux Documentation Project web site at metalab.unc.edu/LDP/index.html#faq. Here you will find detailed FAQs and 'HOWTO's relating to this and many other Linux topics.

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Third-party solutions

Perhaps the best known multi-boot utility on the market is V Communications' System Commander Deluxe. This lets you install and run any combination of PC-compatible operating systems, including Windows 95/98, Windows 3.x, Windows NT, DOS, OS/2 and all of the PC-compatible UNIXes, including Linux.

The potentially messy process is simplified by System Commander's OS Wizard which will even determine whether additional partitions are required and if so create the new partition completely automatically. If you long for multiple operating systems and the simple life, then fork out for System Commander Deluxe <www.v-com.com/> or something similar, like PowerQuest's BootMagic <www.powerquest.com/ bootmagic/index.html>. There are a number of shareware alternatives available, too, such as Bootmenu Boot Manager, which can juggle up to 15 operating systems.

PCW CONTACTS

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